Agribusiness

Beyond Covid

The pandemic has caused digital adoption across all industries to surge and agribusiness is no exception. We look at some of the technological advancements that are shaping the industry to maximise volume, drive economic progress and provide sustainable and productive solutions.

INSIDE

Images / Getty Images, 123RF

Agribusiness

What lies ahead in NZ agri-future?

The image of giant robots bestriding fields with a drone circling overhead is futuristic.

But it foreshadows a future where farmers who are already embracing artificial intelligence (AI), robotics, smartphone management systems and all manner of innovations to underpin a resilient agribusiness sector, are shifting to remain ahead of the curve, as **Andrea Fox** reports today.

It's also necessary to adopt new technologies if New Zealand farmers are to reduce their reliance on low-cost human labour and produce new premium products to meet global tastes. **Glenys Christian** went to Fieldays to look at some of the exciting innovations there.

Agribusiness
Fran O'Sullivan

Plant & Food Research's **David Hughes** told the *Herald* his Crown Research Institute wants to develop new horticultural varieties that might one day rival the success of the SunGold kiwifruit variety.

Keith Woodford foreshadows the development of more composting "mootels" in Canterbury, reducing effluent on pasture. As **Brian Fallow** cautions, the status quo won't cut it when it comes to meeting NZ's climate emissions' obligations. A challenge which is also top of mind for Fonterra's **Kelvin Wickham**.

There's more besides: The return of wool as a critical component of the furniture industry and the challenges posed by food waste.

On the social front, **Tim Henshaw** and **Tim Mackle** look at how farmers are weathering stress.

Māori agribusiness leaders like **Mavis Mullins** and **Paul Morgan** are showing the way by forging people-to-people links which are all-important in prime markets like China.

It is clear that New Zealand agribusiness has proved remarkably resilient in the face of the Covid-19 pandemic.

Government agencies such as NZ Trade and Enterprise (NZTE) and the Ministry for Primary Industries (MPI), as Cabinet Minister **Damien O'Connor** affirms today from his place in a managed isolation facility, have proved to be much more than a backstop for Kiwi farmers and exporters.

They have been leaders in keeping Covid-affected markets open for NZ agricultural exporters.

But as the NZ IBF's (International Business Forum) **Stephen Jacobi** reports we could do more — much more.

Enjoy the report.

INSIDE AGRIBUSINESS 2021

Agribusiness 2021

Executive Editor: Fran O'Sullivan
Writers: Bill Bennett, Glenys Christian, Andrea Fox, Tim McCready, Mark Peart, Ian Proudfoot, Graham Skellern
Subeditor: Isobel Marriner
Layouts: Isobel Marriner
Cover: Richard Dale
Proofing: Natalia Rimell
Online: Natalia Rimell
Advertising: Tim Wilson

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Agribusiness

Weathering fierce headwinds

Our primary sector has shown remarkable resilience, says **Damien O'Connor**

I've just arrived back from Europe and am pleased to report we are making good progress on our free trade agreements with the UK and the EU.

The highlight of the trip was nailing down an agreed timing of August for an "in-principle" agreement with the UK.

Though my focus abroad was on diversifying New Zealand's trade portfolio, it is impossible not to comment on a world that very much remains in the grips of Covid-19.

There were just 14 passengers on my flight from Auckland to Singapore. Our journey required continuous social distancing at every step. People remarked on the novelty of meeting in-person – something many hadn't done since the pandemic began. There were no hand-shakes. Masks and hand sanitiser were a must.

Everywhere I looked there were signs of communities doing their best to adapt to these extraordinary times.

Counterparts often said to me the pandemic has reminded us how interdependent we are – no one is safe from Covid until we're all safe from it.

As I wait out MIQ with many other Kiwis and visitors, I'm reminded of the importance of our border management. Our decision to treat our Covid response as a health one first has made an enormous difference to our quality of life here in Aotearoa.

Throughout that Covid response, it has been our primary industries that have kept product flowing through supply chains to market and revenue flowing into the country. The Ministry for Primary Industries' SOPI (Situation and Outlook for Primary Industries) report, which was released at Fieldays, tells that story of resilience and growth.

> There is a world of opportunity in working out in rural New Zealand. We want our rural communities to be vibrant and thriving.

At a time when economies around the globe are taking severe hits due to the pandemic, New Zealand's food and fibre export revenues dipped by only 1.1 per cent. Given the headwinds of the Covid storm this is remarkable resilience.

The SOPI forecasts growth across the sectors over the coming year, culminating in a record $49.1 billion in export earnings. This growth will be sustained over the coming years with export revenue hitting $53.1b in 2025.

The primary sectors' resilience is a big factor in our overall GDP growth of 1.6 per cent in the year to March, which has us outperforming Australia, the United States, Canada, Japan and the United Kingdom.

Looking ahead, the challenges for our agricultural sector relate to environment, shifting consumer behaviours, and labour. Front-footing these challenges will help convert them into opportunities.

Partnership with industry is core to the Government's approach.

On environment, we're working with industry so farmers can integrate upcoming climate and freshwater requirements into their business planning. Budget 2021 committed $37 million to accelerate the uptake of integrated farm planning, ease compliance and deliver skills to guide farmers on this journey.

The He Waka Eke Noa partnership will deliver a farm-based emissions pricing system, with all farmers being able to measure and manage their emissions by the end of 2022.

Last year we launched the Fit for a Better World roadmap to boost productivity, sustainability, and jobs in the primary sector.

We brought forward almost $96m to kickstart delivery of the roadmap, including $84m to scale-up the Sustainable Food & Fibre Futures Fund (SFFF) to boost innovation efforts, on top of the $40m already available each year.

Since SFFF launched in mid-2018, we've committed more than $111m to new projects of a total investment of almost $250m.

Our success as exporters comes from being tuned into our customers and market conditions, and thinking innovatively.

We know consumer values are determining what people will pay a premium for in the supermarkets, at the restaurant, and online.

Where did this come from? Who produced it? Were those people paid well? Can I be sure my food decisions have minimal impact on the environment? Is this good for my kids? What's my carbon footprint?

Exporters get asked this. I get asked about it in trade talks.

The world is changing and we must move with the times.

Getting the right results will actually add value to our exports.

New Zealand has to move from volume to values – that is, aligning our story with the values of our consumers. And of course, being able to demonstrate it.

And this brings me to people.

Our primary producers are facing labour shortages. In the short term the Government is doing what it can to bring people in across our borders whilst managing our MIQ capacity.

It's also true that labour shortages existed prior to Covid and that we need long term strategies to address this.

Our Opportunity Grows Here campaign has placed more than 5200 people into the sector since spring last year. That's a great start.

My message to New Zealand is that there is a world of opportunity in working out in rural New Zealand. We want our rural communities to be vibrant and thriving.

I'm proud of our primary industries. We're already amongst the most efficient food and fibre producers in the world.

Our investments in new technologies and practices are going to greatly enhance our sustainability and the nutrition we provide our consumers.

In achieving this, our farmers will lead the way to making New Zealand the best country for the world.

● *Damien O'Connor is Minister of Agriculture and Minister for Trade and Export Growth*

Agribusiness

Shining through the turbulence

Agribusiness
Tim McCready

Accelerating trends in agribusiness are providing opportunities for New Zealand

Alternative protein has reached a tipping point where it is becoming mainstream.

Agribusiness was the shining star for the New Zealand economy last year. Its status as an essential industry meant it was able to continue during lockdowns and provide food to an uncertain world.

But a year on, the world remains turbulent. While we can expect to see markets slowly return to a resemblance of normality as the vaccine rollout continues and lockdown restrictions are reduced, global megatrends impacting the agriculture industry will continue to shape the future of agribusiness.

Need for a cohesive national strategy on sustainability

Covid-19 brought a discussion around sustainable and safe food systems to the fore, with the boosted emphasis on climate change, carbon offsetting and ESG (environmental, social, and governance) credentials all having an impact on the behaviour of consumers.

They are looking for sustainable business models that consider all aspects of the production process — including the impact on natural resources.

Some developments on this were made earlier this month, with the Climate Change Commission releasing its final report:Ināia tonu nei: a low emissions future for Aotearoa. It lays out a roadmap for New Zealand to meet its greenhouse gas reduction obligations by 2050, and calls for immediate action by government, local government, individuals and businesses.

For agriculture, the Commission says New Zealand needs to reduce its livestock numbers by 13.6 per cent by 2030. It predicts that while New Zealand will still produce roughly the same amount of milk and meat, it will do so with fewer animals, and expects some farms to convert from livestock agriculture to horticulture. It says low-methane sheep will play an important role (and help cut methane 10 per cent by 2030), along with a reduction in the use of fertiliser, and new technologies will need to come on board, such as vaccines that can help reduce emissions from livestock.

Transparency into provenance and supply chains

As part of making more conscious sustainable choices, consumers in some of our major trading markets are demanding detail and transparency on provenance and supply chains of food, to make informed decisions about what they eat. In some cases, this detail is sought down to individual farms and farmers.

A discussion paper on the future of food and the primary sector by University of Auckland thinktank Koi Tū: The Centre for Informed Futures, headed by Sir Peter Gluckman, notes that this trend is one New Zealand can approach with some confidence. We have high social and environmental values, and our primary sector produces quality, safe animal protein with a low carbon footprint relative to our competitors.

But while we have a favourable global profile, Koi Tū says that in order to sustain it for our high-value agricultural exports we must develop a cohesive national strategy that is connected to quality assurance:

"Our national product branding needs to be refreshed and not just seen as a slogan. It needs to be linked to measurable progress on key indicators of value to consumers. These are likely to be origin and environmentally linked."

The new coal?

Although it may seem extreme, the growing awareness from consumers of the environmental impact of the food they eat means that some are predicting beef to become "the new coal".

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Agribusiness

Renaissance is under way

Agribusiness can secure Aotearoa's place in a big, beautiful tomorrow, writes **Ian Proudfoot**

We need to accelerate ocean "forestry" (the growing of seaweed and other plants) for food and carbon sequestration.

There has never been a better time to be part of the global food system.

US$65.4 billion of venture investment into disruptive innovation in the last decade has set the platform for the most fundamental changes in food and fibre in over 10,000 years. A food renaissance is under way, accelerated by the reconnection of people to the food they eat during a pandemic. Opportunity exists everywhere in the food system's Great Big, Beautiful Tomorrow.

Add to this high dairy prices, strong demand for red meat, record kiwifruit returns and good timber prices; the outlook for New Zealand's food and fibre producers, processors and exporters has, on the face of it, never been better.

However, this year's KPMG Agribusiness Agenda (Agenda) found fatigued leaders dealing with the practical challenges of the pandemic – labour shortages, broken supply chains – as well as having to find the time to understand, engage and respond to the Government's change agenda. This is leaving limited leadership capacity to think about the extensive opportunities available in the future food system.

For the first time, in the 12 years of writing the Agenda, we concluded there is a risk that our food and fibre organisations might miss opportunities available to participate in the food renaissance. This could cost us the ability to generate product premiums in global markets, slow our ability to transition to a lower-carbon, more sustainable country, that ensures every Kiwi has access to nutritious, affordable food and at the same time, address some of the fundamental health challenges we face as a country.

The future will be created by those that lead this global shift. Taking an active role in leading change across the food system, as New Zealand producers have done over the last 40 years in bringing innovation to pastoral farming, forestry, horticulture and wine, will provide opportunities for us to unlock new value – environmental, social and economic – across all our food and fibre activities.

An area of interest is the opportunity to maximise the potential inherent in our oceans. New Zealand's exclusive economic area is 93 per cent ocean, meaning we have significant scope to unlock new aquaculture capacity, including automated deep-water farming systems, to produce food and nutritional co-products. We also need to accelerate ocean "forestry" (the growing of seaweed and other plants) for food and carbon sequestration. The ability to sequester carbon into plants in the ocean, underemphasised by the Climate Commission, should be central to our decarbonisation discussions.

It offers a higher quality, more ethical carbon offset to some of the plans to plant trees on every hectare of land that can be acquired, regardless of its productive potential.

Another massive opportunity for New Zealand exists in bioproducts. Contributors to the Agenda suggested that if we maximise this opportunity, it could add $30 billion a year to the economy. This is about creating commercial alternatives to raise the value of the wood we grow providing viable economic alternatives to exporting logs (structural timber products, bioplastics and polymers or biofuels). But this is only part of the bioproducts opportunity. Everything we grow comes with additional biomass (orchard prunings, grape marc, fish bones, animal effluent). Our goal should be maximising the value created (or costs saved) from utilising 100 per cent of what we grow. This could be new products, new ways of substituting fossil fuels out of existing products, but it could be using off the grid effluent to replace existing energy to generate process heat.

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>
> Ian Proudfoot

While political will is low, a mature conversation around the utilisation of biotechnologies can no longer be deferred. New tools since the last comprehensive discussion on genetic technologies (including gene editing) raise very different questions to those debated previously. They are being used extensively around the world to develop food with higher nutritional density, plants better able to withstand weather extremes and cultivars that can assist in managing greenhouse gas emissions. A considered approach to these technologies would ensure we can retain the world's best biological scientists. It could also be critical to protecting our markets, where risks are increasing that if we don't use certain technologies our products could be ignored by premium consumers and become subject to market access restrictions.

The constantly growing population of sophisticated and informed customers around the world presents us with a significant opportunity to capture more of the value in the products that we grow. However, it also increases our risk of losing custom if the story we tell the world does not align with our reality. While there is more competition for the premium consumer's dollar, we are recognised as a producer of safe, free-range, high-quality products but we need to lift our storytelling to move from sustainable to evidence-based products. Evidence-based products have all aspects of the experience informed by science, are backed by data and enhanced through authentic provenance.

There is no doubt that global interest is growing in regenerative farming. There is no consensus over what constitutes a regenerative system, presenting a unique window to take a lead in defining what we consider to be the essential elements of such a system. The work currently underway as part of the Ministry of Primary Industries' "Fit for a Better World" programme to define the essential elements of Te Taiao, production systems that balance the health of land, water, soils and other living things, presents an opportunity to create a real point of difference for our food and fibre products. Completing this work quickly and providing producers with the pathway and tools they need to evolve their production systems offers the opportunity to increase the value of exports while improving environmental and health outcomes.

It is also critical that we approach emerging modern food opportunities with an open mind. The future of our food system is not either traditionally farmed or modern foods (synthetics, plant-based, cultured foods, etc.) but is very likely to be a mix of both to deliver the necessary nutrition to global consumers. If we understand the expectations of our community and consumers and do the work necessary to exceed these then we should be able to continue to sell our naturally produced food for a premium. We should be exploring the opportunities inherent in modern food; there will be premium niches that emerge that offer the potential for us to grow the nutrition we provide to the world and the value that this delivers to the NZ economy.

The opportunities available are significant but much needs to be done. We need recognition that an individual's time is finite; organisations must invest in greater leadership capability to respond to the structural fatigue that is currently being experienced and provide the time to think about the future. Our leaders need to ensure that they have the time to seek diverse opinions and reinvest in their networks and relationships as borders reopen.

Collaboratively, we should explore corporate venturing to provide access to the most relevant global innovation shaping the farming systems and products of the future. The government needs to ensure that the regulatory programme is joined up across agencies, consultation is targeted, and changes are made with enough runway to allow realistic time for change. Finally, directors and governors need to govern for growth, supporting their executive teams to focus on opportunities that will create long term benefits for the organisation, for communities, and for the environment.

● *Ian Proudfoot is Global Head of Agribusiness, KPMG.*

Shining through the turbulence

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Alternative protein has reached a tipping point where it is becoming mainstream, with plant-based options such as Beyond Meat and the Impossible Burger increasingly common on restaurant menus and in supermarkets. Last year around 13 million metric tonnes of alternative proteins were consumed globally – including those from plant-based ingredients, cultured meat products, and alternative sources such as insects. This represents around 2 per cent of the animal protein market.

Boston Consulting Group (BCG) believes by 2035 – when alternative proteins reach full parity in taste, texture, and price with conventional animal proteins – 11 per cent of all the meat, seafood, eggs, and dairy eaten around the globe is very likely to be alternative. This could save as much carbon dioxide equivalent as Japan emits in a year, conserve enough water to supply London for 40 years, and promote biodiversity and food security.

In late 2020, Singapore gave the world's first regulatory approval for meat that doesn't come from slaughtered animals. Eat Just's chicken meat is grown from animal muscle cells in a lab, and the company says this "breakthrough for the global food industry" is one it expects other countries to follow.

New Zealand innovators are working to meet this growing demand for alternative protein. Auckland-based Sunfed Meats recently launched its Bull Free Beef product made from vegetables and cocoa butter, alongside its range of other plant protein "meat analogues" including Chicken Free Chicken and Boar Free Bacon.

FoodHQ, which represents NZ's food innovation organisations, said in a recent report that emerging proteins are a diversification opportunity that could complement New Zealand's traditional animal-based protein sectors.

"While our dairy products, meat, wine, apples and kiwifruit will underpin NZ's food exports for many years to come, we must explore the opportunities to continue adding diversity to our food product offering in order to meet global demand," says FoodHQ chief executive Abby Thompson.

> As new technologies emerge and farms become better connected to digital infrastructure, the use of precision agriculture and other technologies in agriculture will dramatically accelerate.

Technology to boost productivity and reduce emissions

Sensors, robotics, big data and artificial intelligence are other technologies shaping the future of food production and farming.

They all contribute to what is known as precision agriculture, which was already becoming mainstream before the pandemic, but has in the past year demonstrated its importance in creating resilient farming systems.

A local example that integrates several of the above-mentioned technologies is Halter – a company developing a smart collar for fence-free animal management. Last month, Halter secured $32 million in a Series B round led by Australian VC firm Blackbird Ventures (supported by current shareholders including Rocket Lab's Peter Beck).

The collars, loaded with Bluetooth, GPS and solar panels, allows farmers to virtually herd their stock from anywhere by using an app on their smartphone. Sound and vibration help direct cows, and the collar can also monitor the wellbeing of the animals by detecting unusual movement which might indicate if it is lame or on heat.

The technology works well with NZ's farming system, as well as other regions that put an emphasis on free-range, pasture-based farming such as Europe and South America.

As new technologies like Halter emerge and farms become better connected to digital infrastructure, the use of precision agriculture and other technologies in agriculture will dramatically accelerate.

These technologies will play a critical role in helping the industry operate with more resilience, increase food security, boost productivity and reduce emissions in farming systems. All of these are integral aspects of the megatrends shaping a sector that is so important to New Zealand's economy now and into the future.

Agribusiness

A BRAVE NEW WORLD

AI is alive and kicking in our orchards and paddocks – but that doesn't mean there's a Terminator in the milk tank

Agribusiness
Andrea Fox

Somewhere in New Zealand a computer is learning from an expert horticulture pruner the best place to cut a branch. The computer will go on to help a beginner pruner make the right decision.

On a kiwifruit orchard in the Bay of Plenty, researchers are working out how counting and calculating the density of buds and flowers will maximise the harvest.

In that small aircraft above them is a tool to analyse nutrient content and water stress in the foliage, while over the Kaimais in the Waikato, a dairy farmer knows a cow is unwell even though he can't see her.

Artificial intelligence at work in rural New Zealand. Some of it hasn't been commercialised yet, and there's concern New Zealand isn't investing enough and we risk getting left behind by our agribusiness competitors, but AI is alive and kicking in our orchards and paddocks.

If for you this conjures up images of Terminator-types lurking behind the milk tank or in the wheat crop, a definition of this increasingly used, but poorly understood, buzz phrase, may be comforting.

As AI Forum NZ says, it's important that more New Zealanders have a high level understanding of AI so there is a clearer link from the technology to its many potential applications, but it can be difficult to define what AI is.

No wonder when the term is used to refer to everything from neural networks to autonomous robots in sci-fi movies to the search engine you use to look up pictures of cats.

The forum offers the OECD's definition of an AI system. "A machine based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying degrees of autonomy".

> A good working definition of AI is the science of enabling computers to make decisions in fuzzy and uncertain circumstances.
>
> Mark Begbie

Then there's Dr Mark Begbie's more easily digestible: "A good working definition of AI is the science of enabling computers to make decisions in fuzzy and uncertain circumstances."

And the chief executive of Tauranga-based independent research institute PlantTech is quick to make clear AI is not robotics, but the way a robotic machine goes about understanding the world by using AI.

While robots are examples of AI, so are self-driving cars, smart assistants, disease mapping, predictive texting, automated financial investing, social media monitoring and virtual travel booking agents.

AI Forum NZ again: "The theory and application of AI as we know it today has been around for decades.... however many of the most interesting applications of AI today result from approaches that use machine learning."

Time for another definition: Machine learning is a subset of artificial intelligence which often uses statistical techniques to give computers the ability to "learn" with data – creating models to process, interpret and respond, without being explicitly programmed with a predefined set of rules".

AI in NZ agribusiness

Enter AI in New Zealand agribusiness and the concern of some experts. Machine learning is about big data – we need more agricultural and horticultural data and the investment to get it.

There's some exciting AI work going on in the $6.65 billion export horticulture sector but it is to some extent still catching up with agriculture progress, because the horticulture environment is more complex, says Begbie.

He compares that environment to that in which one of AI's early big success stories, the self-drive vehicles, operates. It's extremely variable – even a traffic light is challenging.

"But when you go out into agriculture and horticulture the world is even more variable. At least a traffic light has three lights and you know what colour is at the top and the bottom and it's always a vertical row.

"But if you're looking at a tree or a plant it's a much more variable structure and varies massively over the year – from sticks in the winter to being covered in leaves in summer."

AI is finding success in progressively more complicated problems and challenges, Begbie says, but to create a reliable AI tool, like training a child, you have to be able to show it a variety of life, which is where data capture comes in.

"Horticulture is typified by smaller players so there's less opportunity for large scale data capture..."

However he's far from glum about progress and offers plenty of examples of groundbreaking work under way, such as the earlier mentioned projects.

While we don't have huge industries like the US citrus sector to supply data, we have very substantial and good "living labs" in our kiwifruit, apple, avocado and wine sectors to develop solutions, he says.

National Survey planned

Dr Amanda Williamson, a Waikato University management school lecturer in strategy and innovation with a strong interest in AI, is about to launch a national survey to measure how far agribusiness is down the track with AI and what barriers there are to progress. The results will form a white paper.

She says AI is important because the business landscape is increasingly uncertain and requires leaders to analyse complex information at a greater pace than ever before.

"Emerging AI technologies help people make sense of information, provide data-driven insights and made rapid evidence-based decisions – think supply chains.

"With data we can improve processes and performance, by augmenting decision-making and building digital products and services through AI.

"Thanks to digital transformation, AI adoption is relatively and cheap to implement for augmenting decision-making around hiring people and selling products.

"But it is not often easy in the early stages of the value chain in primary industries and that is a big concern I have for New Zealand."

Williamson says unless primary sector businesses can invest in collecting good data that pertains to the early stages of production – or partner with businesses that can do it for them – they are likely to be left behind. "AI is only as good as the data it learns from."

In most industries, she says, businesses do not need to worry about collecting data – they collect it every day because most of their work is digitised.

"Data collection is a lot more complicated when it comes to the early stages of the primary industries' value chain. How do you significantly improve plant production if you are not collecting good data on the variables impacting your plants?"

Often collecting data in the early stages of production requires

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Agribusiness

Collaring – the feedback loop

Andrea Fox

New Zealand's $19 billion export dairy industry loves artificial intelligence – this year cows are up to their necks in it.

Cow collars, or intelligent neckbands, are flying off rural store shelves this year, says David McCall, AI expert at dairy industry advocate, DairyNZ.

Hamilton-based agritech company Halter Group has a runaway success on its hands with its solar powered collar and mobile app, which moves and manages cows remotely, acts as virtual fencing and can detect optimal breeding time and deliver cow health alerts to farmers.

Across town, global security technology innovator Gallagher Group, has just signed off a deal fully acquiring Agersens, designer and developer of virtual fencing technology eShepherd, a collar enabling farmers to control the location and movement of cattle using a web application and an intelligent, solar-powered neckband connected to the internet via a base station.

Gallagher, which had owned 50 per cent of Agersens, plans to add to the product all manner of sensors and technology to help farmers with data gathering and cow health and welfare information.

McCall, DairyNZ's general manager responsible for science and economics suggests AI is old hat in the dairy industry.

"AI is enabled by machine learning and big data. It's just a continuum of information technology. It's not all brand new.

"IT in the dairy industry goes back to the late 80s – we had apps before people even used the word."

Measuring factors such as soil utility, how much a farmer should pay for a weaner calf and choosing the best bull to use in a particular herd, those apps have been "decision support" – IT jargon for helping people make decisions, one of the things AI is all about, says McCall.

Craig Piggott, founder of Halter (top), with a dairy cow wearing a smart collar; the Gallagher eShepherd (below).

It's also about "recommending" and "making" a decision.

"We are working with Microsoft and Aware Group (a Hamilton AI solutions exporter) and they break AI down into those categories.

"All that support has come with

> The first real effort is cow welfare, cow wellbeing and proving the systems we run and the care of our animals because animal-farming industries are facing that competitive pressure.
>
> David McCall

financial data as well. The next wave is more into sensors and robotics and some of that is more into 'making' decisions."

DairyNZ is doing a lot of research into feeding Halter and Gallagher products, says McCall.

"A lot of research going on now is sensing whether a cow is lame or about to calve, sensing whether it has a metabolic disease like milk fever. It doesn't sense the milk fever, it senses the cow is not right through behaviour.

At dairy genetics company LIC, also in Hamilton, they're working on sensor technology to detect mastitis, McCall says.

DairyNZ is leading a consortium of Microsoft, Aware Group and Waikato, Auckland and Lincoln universities, putting together researchers with those that can turn the findings into machine learning and AI.

"AI relies on big data and there's not a lot of big data on-farm compared to say climate data. Even the climate data for farmers is only medium data – it's not big, not like a supermarket would have pouring through every day. So we're looking at the best sources of big data and how to capture it, the real practicalities, and how would farmers interact with it.

"Microsoft is over here and very keen. It has said 'okay, there are a lot of people, particularly scientists, out there trying to develop apps, but let's start with the user, how this might work on-farm'."

McCall says weather data will be an important source along with "listening to the cows".

"Getting big data on cows … the first real effort is cow welfare, cow wellbeing and proving the systems we run and the care of our animals because animal-farming industries are facing that competitive pressure."

Robotics is old hat in the industry. But it hasn't really taken off – probably because of farmer "conservatism" about systems change, the capital upfront cost, and because it's a system best suited to small dairy farms, freeing up a person to work off-farm, McCall says. He reckons there are only about 100 in New Zealand. So if farmers are shy about "system" change, how are they going to embrace more AI?

"I think it depends on how easy it is," says McCall. "New Zealand farmers are rapid adaptors," he says, citing the cow collar uptake.

AI is all about precision management – nothing new for Kiwi farmers.

"There's always an adoption period and scientists and others often get ahead of themselves about how easy this stuff is to use and apply.

"But the train has left the station."

Our brave new world of AI

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proactive investment in observational tools, Williamson says.

"The organisations that have invested in collecting data are poised to be the leaders in the market. The intermediaries that own the data may have all the power and leverage in future. My message to businesses: data is a strategic resource, invest in collecting and owning it."

AI will have a transformative effect on primary industries, she says. (AI Forum NZ in a 2019 report predicted AI could bring more than $50 billion in benefits to the New Zealand economy by 2035 – the primary industry is a cornerstone of that economy.)

But Williamson sees a problem.

"Executives cannot yet predict the exact monetary benefits of AI and therefore may provide an insufficient business case for investing the necessary time and resources in its adoption.

"We lack business cases now to illustrate the dollar value of adopting AI and data collection initiatives. AI adoption is not cheap."

Talent pipeline

Williamson's concerns about lack of investment are echoed by Waikato University's new Artificial Intelligence Institute. Associate director Jannat Maqbool says we are not investing in research and building the talent pipeline needed to develop the models New Zealand requires.

"AI can enable predictions across the supply chain as well as downstream demand for products, meaning we can better plan and prioritise resource usage and more effectively

> The intermediaries that own the data may have all the power and leverage in future. My message to businesses: data is a strategic resource, invest in collecting and owning it.
>
> Amanda Williamson

manage and minimise the environmental impact of food production.

"There is a lack of data to train models given the slow pace of digitisation in the sector. This presents a challenge for the short to medium term and is an important consideration in terms of New Zealand being able to move forward in leveraging AI.

"Disparate infrastructure and connectivity in rural New Zealand means we really need to be developing AI to operate on site – at the edge, something that many other parts of the world do not have to consider."

Maqbool says AI can help in enhancing productivity and increasing yields, as well as food quality – important features as the world looks to feed growing populations more sustainably.

Williamson says an obstacle to business decisions to invest in AI is that the benefits are not often immediate. "This is problematic for primary industries, because to continue to compete in the ever-advancing international market we need to make investments in AI in the primary industries now."

Begbie might disagree. He doesn't believe proving the business case for AI is more challenging here than in many other countries.

PlantTech

On the delivery speed of benefits after investment, he cites a PlantTech result on a project for global kiwifruit marketer Zespri. The on-the-vine fruit sizing project, showcased at the recent Fieldays, delivered a credible solution in 18 months.

"We've gone from a standing start to having a credible solution... showing it's scaleable and meets the accuracy requirements of the industry in under two years."

The current kiwifruit sizing system involves manually measuring and weighing fruit on the vine.

Begbie says it barely covers a few thousand fruit and there's high uncertainty in the result.

Working with Zespri this year, PlantTech took the data from four operating AI systems for a week.

It processed the data in two days and gave Zespri calculated weights for around 23 million individual kiwifruit, with four times less error than the manual system.

Why does sizing matter? "It means Zespri can much better target high value markets knowing more accurately what fruit they have. It will bring millions of dollars extra into the economy because they are better able to target markets," says Begbie.

"There are a lot of companies globally trying to count and calculate the weight of fruit while its in the orchard and I can say hand on heart the solution we have developed is the most accurate in the world for kiwifruit."

PlantTech is now looking to apply the system to other fruit crops.

"We are confident will be up there with the best in the world."

Another target for the system is the post-harvest sector.

"If they have a better understanding of what is coming in from the orchard they can better prepare around how much, and which, cool storage facilities to have.

But also there's real potential to release working capital.

"Without an accurate knowledge of what is coming in, there is contingency buying of cardboard packaging, for example, because it varies by the size of the fruit."

Packhouses bring in millions of dollars worth of packaging that may be carried over unused from one season to another.

That working capital could be doing something much more valuable than gathering dust.

Begbie doesn't believe growers need deep pockets to be keen on adopting AI.

There were plenty at Fieldays "really driven" by the desire to operate more efficiently and sustainably, he says. "We are building relationships and looking to work directly with them."

But he agrees more data gathering wouldn't be a bad thing.

Labour shortages

AI, or at least robotics, have had a lot of airtime as the primary sector grapples with a critical labour shortage. The issue is not new but has been emphasised by the pandemic, with thousands of seasonal workers and backpacker labour shut out of New Zealand.

As Begbie says, robotics and AI are not the same thing but robotics has an assistant role in AI.

There's been a flurry of work in the past two years to find robotic harvesting solutions that don't damage fruit, which has to be picked by the piece.

A broad range of demonstrations has shown the dexterity challenge has been solved without damaging fruit from berries to apples to kiwifruit, he says.

But pace is a problem.

"If you look at a lot of these

continued on B8

Agribusiness

Our brave new world of AI

continued from B7

demonstrations of picking, they're extremely slow. In a kiwifruit orchard with an efficient (human) picker, it's fruit per second, not seconds per fruit. I think we are still five, maybe 10, years away from that picking rate."

Meanwhile the structures and operations of orchards are changing to improve productivity and the labour shortage problem while improving health and safety. And the AI work goes on.

In Hawke's Bay a prototype is hoovering apples off the tree, and a human on a platform directs them to a conveyor belt which takes the fruit.

Work is under way to enable orchardists to be less selective about skills.

Begbie says Auckland, Waikato and Canterbury universities are working with partners trialling augmented reality to teach pruning skills. Augmented reality is an interactive experience of a real-world environment where real world objects are enhanced by computer-generated perceptual information.

Using AI, a computer learns from an expert pruner to understand where to make a cut.

"Then you can bring in lower skilled pruners because the computer will help them make that decision. These are examples of robotic or AI technology not solving the whole problem but making it easier for humans to solve."

Commercialisation is probably at least two years away, Begbie says.

Meanwhile, PlantTech has been busy this year using AI to analyse nutrients and water stress in foliage using an aircraft with hyperspectral imaging which analyses a wide spectrum of light instead of just assigning primary colours, red, green, blue.

PlantTech Research Scientist Istvan Hajdu sets up the GNSS base station for data logging.

The aim is to provide feedback on where a grower doesn't need to use nitrogen and how to optimise water use.

"We can also look at biodiversity which is one of the things that excites me. If we can do this across sectors, if we can get data moving and sharing between sectors we can start to understand the environment at the catchment level."

New generation satellite data offers the early promise of opportunities to manage the whole environment for sustainable yield, Begbie says.

Smaller satellite orbits much closer to earth would enable daily data gathering instead of weekly, and while an aircraft could cover 2000 ha a day, a satellite could do the whole country.

All that data will lead to much more informed decisions about how the whole ecosystem is working.

So, plenty of promising projects, but when will working people get to use the results?

Delivery

Begbie says kiwifruit sizing should be delivering value in Zespri's core systems next harvest and PlantTech is talking to a player in post-harvest kiwifruit and some other crops about deploying the technology.

"I don't think it's unrealistic to expect that being used at a small scale commercially next year."

The US is a potential export market.

On the aerial assessment research, PlantTech's talking to several parties how to get the work into a commercial tool. But Begbie doesn't see why it shouldn't be at early scale commercialisation within 18 months.

As for the biodiversity and sustainability catchment assessment work, it's likely to get the attention of authorities for its biosecurity and biodiversity management potential.

"We are talking to government agencies about how we can support these sorts of issues. That very rapidly is likely to roll down to the likes of regional councils who will be charged with gathering this data."

But it will be commercial companies which take PlantTech's work to market.

"We create core AI engines but our model as an independent research organisation is to partner with commercial companies so we can embed new capabilities into their products.

"(This way) we can scale much more rapidly. We don't have the slow start-up phase, we can drive revenue back into technology in the form of licence fees and whatever.

"Also by building trust and confidence we can encourage those companies to reinvest in medium term research."

Agribusiness

Upbeat MPI report buoys sector

Ray Smith tells **Bill Bennett** MPI's Situation and Outlook for Primary Industries (SOPI) June 2021 report has enjoyed an upbeat reception.

When we looked at our forecasts we thought this year would be flat, and probably next year as well. We were surprised at how well things held up and the pull-through demand for our product internationally.

Ray Smith

Ministry of Primary Industries (MPI) director general Ray Smith says three positives have buoyed people working in the sector. First, there is the fact that we forecast a $2 billion growth next year. That's roughly 3.5 per cent growth.

Second is the realisation that the sector did well in what was one of the most difficult years in living memory.

"If you went back 12 months, we were worried about holding our own as the world went through the depths of Covid," says Smith. "We came up with a remarkable result that was only 1 per cent off the previous year's export revenues. That was only softened a little by the exchange rate.

"That gave people a boost. They knew they'd had a tough year with their heads down: whether it was looking for a container or a ship; trying to manage international market access issues; or coping through lockdown. The reports shows they could look up and see that we have done incredibly well and the outlook is even better."

The third positive is in MPI's 'Fit for a Better World' update. This looks a future pathway for the sector. Smith says this shows how we can grow further and achieve our sustainability goals. This is important because a sustainable primary sector will reinforce New Zealand's market opportunities and ability to get good prices over the long run.

Diversity is a key to long term growth. Today dairy production is about 40 per cent of the primary sector by value.

Smith says horticultural is a strong performer. It sailed through the Covid pandemic and continues to grow.

Forestry took a dip in 2020 and has yet to return to 2019 levels but is on its way back up. "We're getting amazing prices out of China for our wood products. The seafood industry is bruised. It's been hard. Crayfish was a problem last year, but it has come back. It has been hard for the industry to get its product to market. It doesn't help that restaurants were closed and there are challenges with freight. Looking ahead we're seeing a return to a growth path for all the sectors."

The positive numbers in the SOPI report were not expected.

"When looked at our forecasts we thought this year would be flat, and probably next year as well. We were surprised at how well things held up and the pull-through demand for our product internationally.

"One of the things that we did well, and it underpinned this, was the way the primary sector kept operating all the way through Covid. Forestry went into a closed-down mode, but the rest of the sector didn't. We kept going to work and all the protocols we've put in place to keep people safe mean primary production just carried on rolling through.

"At a time when high numbers of people each week were catching Covid in New Zealand, we had minimal experience of it in the primary sector. The workforce in meat works, dairy factories and the larger production facilities were safe and could continue because of the controls we put in place. We never lost production capacity. In some parts of the world the meat industry suffered because people work close together in processing plants and become vulnerable to spreading the disease."

Not losing product was part of the success story. The other part of the story is that overseas demand for New Zealand products, especially fresh products like Kiwifruit, where there's a health appeal, became even more prominent.

The Made with Care marketing campaign helped. Smith says it was an adjusted version of a tourism campaign. "We couldn't get tourists to come to New Zealand, but we could keep telling them about New Zealand. The international campaign linked back to primary products.

"These things reinforced the messages we sent to the world: we were proud to be able to bring them food and they would know it was safe because it was from New Zealand. It worked here to give the primary sector a lift. People felt they were valued and that we had done a good job on the world stage by continuing to provide the products people want. The demand continues to be strong, so there's a good outlook for the coming year."

New Zealand managed to do a good job with international relationships especially maintaining a positive relationship with China where others have not done as well.

"There were issues, just like every other year," says Smith. "But they were resolved along the way. All the extensive work that has gone into our trade and market access relationships over the years has paid a dividend. This, at a time when we couldn't see people face-to-face and had to use Zoom.

"I observed that myself in engagements I with my counterparts in Vietnam. We were advancing an agricultural co-operation agreement which we will sign soon. It was done with great enthusiasm. I think relationships have stood us in good stead and New Zealand remains well regarded."

International supply chains have emerged as a tension point over the last year. Smith says companies in the primary sector have been stressed trying to find places on container ships. "Then we've had a problem with ships being diverted away from New Zealand, sometimes, with only a day or two's notice. Our producers are managing to get products out, but at times they miss the key windows they would prefer to have to get products to international markets.

"But it's not the same for everybody. And that has been part of the Covid story. Things are lumpy. Some of our producers will tell you they have seen good supply chain performance. Others will tell you they struggled. Once again this can have a lot to do with pre-existing relationships."

On top of the difficulty of shipping products, the cost of shipping has increased. Smith says he expects that trend to continue. "It was hard for people to anticipate the snarl up in the supply chain and we don't know how long it will take to return to normal. We think it will continue to be a stress point and we will keep working with industry to find ways to help."

He says the Government supported airfreight scheme that aims to keep freight moving has done a lot to ease the problem. Last year government support enabled 6000 flights carrying 120,000 tonnes of freight worth $8 billion. The scheme also provides support to keep passenger flights running and maintaining international connectivity.

"This has worked well. It's been a tremendous boon for people to offset some of the extra costs and ensure high value products can get to market on time. One of the most crucial things we need to do during these times is to keep our place in a market. Your product has to stay in position."

MPI believes the supply chain issues are likely to roll on well into next year. It could be longer. It will stabilise, until that happens businesses need to find medium-term strategies to get their products out. Smith says in many cases they are working together on the problem and looking for mutual advantages.

The pandemic has underlined the essential interdependence of modern commerce. It's not only a matter of getting products to market. Many people fly around the world providing crucial labour skills first in one place, then another. This has come to a stop. We now know more about the fragility of supply chains and this will need to be addressed as life and business returns to normal.

New Zealand's currency remains strong at present. Smith says this takes an edge off our international competitiveness and flattens export earnings. He says he sees this continuing but there's a growth path and Smith says that can accelerate through MPI's Fit for a Better World programme.

There's an opportunity to move to higher value products. Yet he says much of New Zealand's value continues to come from the volume of quality product produced here. He sees a move to build on our sustainability credentials as a way to preserve price and grow margins over time. This applies as much to large volume commodities as to niche products.

"It's not going to happen tomorrow, but people on the other side of the world who import our products are going to want a product that's lower in carbon that's friendly to the environment. They want a product that they know has been produced leaving natural resources in a better state. As a result, it's going to be a consumer preference. I think that sees the sustainability credentials becoming potentially a price differential over time. And at least we can maintain a position in market with the products that we are so good at.

"We have a massive competitive advantage of producing dairy and meat because we can grow grass so easily.

"If we build on sustainability, reduce greenhouse gases, improve our fresh water and add traceability to our products we will continue to be competitive."

● **Made with Care — B24**

One of the things that we did well, and it underpinned this, was the way the primary sector kept operating all the way through Covid. Forestry went into a closed-down mode, but the rest of the sector didn't. We kept going to work and all the protocols we've put in place to keep people safe mean primary production just carried on rolling through.

We're getting amazing prices out of China for our wood products. The seafood industry is bruised. It's been hard. Crayfish was a problem last year, but it has come back. It has been hard for the industry to get its product to market. It doesn't help that restaurants were closed and there are challenges with freight. Looking ahead we're seeing a return to a growth path for all the sectors.

Looking forward

- Export revenue food and fibre exports forecast to hit a record high of $49.1 billion in the year to June 2022.
- Sustained growth is forecast year on year, hitting a further record of $53.1 billion for the year to June 2025.
- Overall export revenue for the current 2020-21 year continues to be strong, with only a slight dip of 1.1 per cent forecast.
- In January 2021, NZ signed an FTA upgrade with China, eliminating tariffs for 99 per cent of New Zealand's nearly $3.3 billion wood and paper trade to China.
- To drive New Zealand's recovery from Covid-19, NZ launched the Fit for a Better World — Accelerating NZ's Economic Potential roadmap to boost productivity, sustainability, and jobs.
- Almost $96 million has been brought forward to kickstart delivery including $84 million to upscale Sustainable Food & Fibre Futures (SFF Futures) to further boost innovation efforts, on top of the $40 million already available each year.
- Since SFF Futures launched in mid-2018, more than $111 million has been committed to approved new projects of a total investment of almost $250 million.
- Partnerships like He Waka Eke Noa, our Primary Sector Climate Action Partnership, are working with farmers and growers on practical solutions to reduce emissions and build resilience to climate change.

Source: MPI's Situation and Outlook for Primary Industries (SOPI) June 2021 report

Agribusiness


Alliance's Lorneville plant, near Invercargill.

A perfect storm for producers

Diversification and diversion have helped Alliance to weather the Covid waves, writes **Mark Peart**

A focus on the food service sector and development of its premium brands portfolio are key strategies the Alliance Group is employing to overcome global supply chain issues caused by the Covid-19 pandemic.

Alliance Group general manager-sales Shane Kingston says these issues present the farmer-owned meat marketer and processor with its most significant challenge currently. Like many NZ exporters of primary produce, it's dealing with a perfect storm of container shortages, delayed shipping transit times, and productivity logjams at ports, and with 2020 a year of unprecedented global volatility.

Despite this, Kingston is upbeat about the company's prospects as it transitions to become a world-class food and solutions co-operative, because of a strategy predicated on maximising operational efficiency and capturing greater market value.

He and his sales team have had to be nimble in the past year to 18 months as sales channels, particularly for beef in China, dried up and prices slumped.

They had to move fast to divert product across markets and change product forms for the different channels.

As Covid-19 spread around the globe last year, key economies and markets in Europe, North America and Asia also went into lockdown, demand became increasingly unpredictable, and prices softened. Beef prices declined over the same period and there was a significant price correction for venison.

The company, however, has been able to weather the storm, Kingston says, through product diversification into retail and delivered food service channels in markets such as the UK and US.

Alliance worked with overseas customers to make sure products continued to flow and changed product forms so cuts of meat were produced that were more versatile and could be sold through multiple channels. It also looked to reduce inventory risk as the Covid-19 pandemic gathered pace.

Shane Kingston and his sales team have had to be nimble in the past year to 18 months as sales channels, particularly for beef in China, dried up and prices slumped.

Kingston says a good example of where opportunities exist for Alliance Group to enhance the profile of its red meat is the US, on the back of growing demand from consumers for products that are more natural, healthy and better for the environment and animal welfare.

Last year the company launched a premium lamb offer for farmer-suppliers as part of its differentiation of red meat products. The Pure South Handpicked Lamb programme uses an assessment system to measure quality, with the qualifying lamb exported to premium retail markets in North America and Asia.

Suppliers receive a minimum additional 10c/kg premium for this product on top of the 15 cent premium Alliance Group currently pays for lambs raised without antibiotics.

The Handpicked Lamb programme built on a successful programme for beef, with the end product being supplied to increasingly discerning consumers around the world who are willing to pay a price premium for the company's red meat products.

The programme is open to Alliance Group's Platinum and Gold shareholders, who supply 100 per cent of their ovine livestock to the company.

The meat is hand-selected through Alliance's plants and then aged to ensure quality.

The Handpicked Lamb programme expands the co-operative's award-winning Handpicked Beef range — the 21 Day Aged Beef and the 55 Day Aged Beef programmes.

Kingston says farmers supplying stock through these programmes are enthusiastic about them and are constantly striving to maximise quality.

He says to accommodate the expansion of the premium beef programme for suppliers, Alliance Group has embarked on a major reconfiguration of several of its plants, led by a $37 million investment in its Lorneville plant near Invercargill.

The reconfiguration is part of the company's beef growth strategy and is in response to farmers seeking more beef capacity in peak season.

The investments are also part of a plan to manage refrigeration space across the company's network of plants so that they keep running as efficiently as possible and so breakdowns are kept to a minimum.

The investments for Lorneville approved in the past year total $37.1 million, and comprise:

- $5.4 million to re-configure the venison plant so it can process cull cows.
- $3.2 million to upgrade an engine room.
- $12.5 million for a primal cutter and middles machine.
- $16 million to automate warehousing.

The company began processing cows and light bulls at Lorneville near Invercargill in April after the completion of an 18-month project to further upgrade its venison plant on the site.

It has seen a steady increase in supply volumes year on year and farmers have been seeking more beef capacity in peak season. The Lorneville investment programme meets this need but also benefits the company's deer farmers who have access to increased venison processing capacity.

The new beef processing facility will free up space at the co-operative's Mataura plant, which is also in Southland, for prime steers, heifers, and bulls.

Kingston says the focus on a premium beef portfolio and strengthening its beef performance at its Mataura, Levin and Pukeuri (Ōamaru) plants are deliberate responses to the historic global market volatility.

The project, apart from ensuring consistency of productivity across the company's processing network, creates a longer season for its venison/beef plant employees at Lorneville and adds new jobs to the region.

Alliance Group is Southland's largest employer and the Lorneville plant alone has almost 2,000 people in total onsite at peak capacity.

The company's last annual report said plant performance across its network continues to improve year on year.

"Yield performance is improving across all species and this means we are capturing more saleable product. Quality is also improving with the number and value of customer complaints falling."

Plant reliability across every species has also risen due to the company's investment in plants, planned maintenance programmes, and the co-operative doing a better job of training and developing employees to manage breakdowns, which were becoming fewer, thereby improving processing capacity for farmers.

The $16 million, 18-month warehousing project, which accounts for almost half of the Lorneville project expenditure, will introduce automation to the warehousing system and laser-guided vehicles for the storage and retrieval of product.

The plant's current frozen product warehouse operation is more than 30 years old, and the new warehouse management system will improve the health and safety of employees, enable the co-operative to further unlock advantages of scale, and lift the plant's efficiency and competitiveness.

More than 60 people are required to work in the operation during peak processing and manual handling of the fresh product. With each box weighing around 22kgs, employees risk muscular-skeletal injuries, which the new automation process will minimise.

Improved handling of cartons and product, through reduced use of forklifts and fewer cases of conveyors jamming, will reduce downtime in further processing rooms.

Product damage and potential safety risks will also be minimised because frozen product boxes do not stack well in the current warehousing system.

Agribusiness

Big Save for wool industry

Unlikely champion is set to transform the fortunes of a faded star, writes **Lorraine Mapu**

Once a star export earner, the fortunes of strong wool have hit rock bottom. But could Covid-19 be an unlikely saviour?

The story of New Zealand's strong wool exports is one of faded fortunes – from the wool boom of the 1950s, when it was our biggest export commodity – to thousands of tonnes of wool now sitting in storage, as world prices hit new lows.

Recent decades have seen the demand for wool decline to the point where shearing sheep now costs more than farmers make from selling their wool.

Since 2017 the price of wool has fallen from $5/kg to $2/kg, due to changing consumer preferences and global oversupply.

But Covid-19, as they say, has changed everything – and it might be about to change the fortunes of this one-time export high-flyer.

The fickle consumer preferences that relegated this wonderful fibre to the bargain bin, could now swing back in wool's favour as sustainable, traceable and naturally sourced products take on new value.

Around the world, Covid-19 brought into focus the need for consumers to look after their health, their society and their environment.

Being biodegradable, hygienic, naturally fire retardant and sustainably produced, New Zealand wool ticks many of these boxes for consumers.

For the moment, farmers are prepared to carry the cost of shearing, seeing it as an animal health cost, but some are looking to reduce stock.

Already New Zealand will likely produce the least amount of wool on record this season – an estimated 133,000 tonnes, down 2.8 per cent on last year – a direct reflection of declining sheep numbers.

There is no doubt some farmers have been under additional financial pressure due to the low prices, but there are also good reasons why wool is here to stay, why it plays a vital role in a diversified and sustainable farming sector, and why there are many reasons to be optimistic.

Big Save has put even more skin in the game by recently buying four sheep and beef farms in the Ākitio (left), Hawke's Bay and Tararua regions.

Leading the charge

If the cavalry's on its way, it's being led by numerous companies looking to develop innovative and novel uses for wool – from using it for packaging and hygiene products, to making boat hulls from it.

Among them is one of the country's largest retailers of furniture and bedding, Big Save Furniture.

It has seen huge demand for its new range of locally-made furniture, which uses woollen padding and upholstery.

The company has committed to paying farmers a fair price for their wool, in this case at least $4.50/kg – part of its efforts to make its own business and products more sustainable, and to support the primary sector.

Along with paying farmers fair prices, the company has put even more skin in the game by recently buying four sheep and beef farms in the Ākitio, Hawkes Bay and Tararua regions.

Diversifying in this way, and bringing more of its production back to New Zealand, Big Save Furniture is better able to control its supply lines and ensure their long-term sustainability.

As well as investing in research and product development, the company is currently also installing solar panels on five of its showrooms, with an ultimate goal of becoming 100 per cent sustainable.

It has a plan to replace the plastics and synthetic foam in its products with wool, which – being biodegradable – makes them much easier and safer to dispose of at the end of their life.

> Covid was not the first such shock, and it won't be the last, so as a nation – and as farmers – we can't be putting all our eggs in one basket.
> Lorraine Mapu

Big Save Furniture is also exploring using wool for other applications, including using tightly-woven mats as fire-retardant ceiling panels and as a non-toxic alternative to weed-killer, to stop grass from smothering native saplings.

Innovations like these are important for woolgrowers as each new product creates another market for the fibre, and builds the potential for increased demand and improved prices over time.

Everyone loves a winner and this renewed interest in wool is only likely to increase public awareness of the benefits of wool in other products.

The growing movement away from synthetic fibres, towards natural products, will only encourage other manufacturers to join in, further increasing demand.

Back On the Farm

Bringing it back to the farm, there is no question low wool prices have hit farmers in the pocket, but from what we are seeing, for most of them, wool is only part of the equation.

They are also meat producers – some of the best in the world – and most have benefited strongly from improved and consistent lamb and mutton prices in the past few years.

On many of these farms, wool makes up less than 10 per cent of total farm income, and the overall combined income from both meat and wool has increased in recent years.

This has meant the negative impact of low wool prices on woolgrowers has been less than expected, and it has been able to be absorbed by most farmers.

The good news is that any increase in the price of wool will now go straight on to farmers' bottom lines – which bodes well for when wool prices do eventually pick up.

In the short term, wool may not be a significant revenue source for farmers, but once prices rise to the breaking-even point, the income will help to offset the costs of meat production, so will ultimately improve profitability.

There's also a clear lesson in this – the way meat prices have supported farmers through this period is a reminder of the continuing value of diversification.

The global market for our products has never been assured, and – as the pandemic clearly demonstrated – a strong and resilient primary sector needs to be able to manage disruptions like these.

Covid was not the first such shock, and it won't be the last, so as a nation – and as farmers – we can't be putting all our eggs in one basket.

Multiple sources of income on a farm make it better able to weather unexpected changes – whether that be drought, pandemic or changes to customer preferences – and this means they are more sustainable as a business.

Patience will be needed before farmers see higher prices for their wool, but it's clear the fibre's special qualities and our expertise in producing it stands New Zealand in good stead when the world wakes up to wool's potential.

● *Lorraine Mapu is Managing Director, Business Banking, ANZ New Zealand.*

Agribusiness

The new supply and demand

Minimising waste in production addresses global food security and sustainability

Agribusiness
Mark Peart

Minimising waste from agricultural food production to ensure supply and demand are more closely aligned could provide New Zealand with a competitive advantage in our export markets over the next five to 10 years.

The driver for this, in part, according to Rabobank New Zealand's head of sustainable development, Blake Holgate, is the assertive move by multinationals such as Nestle, JBS, and Yum! Brands to reduce their carbon footprint across entire food supply chains.

"Nestle, for example, is looking to be carbon neutral by 2050 through their supply chain, and a big chunk of their emissions will come from on-farm production of milk, for example."

Dunedin-based Holgate, who took on his newly-created role at the start of the year, says such strong environmentally-based market signals from global agribusiness will require NZ primary producers to modify on-farm practices in response.

Not many food growers aren't wise to the commercial sense of adapting to what Holgate calls a "transformational" period for the NZ food production sector, which started about two years ago, and is set to continue for at least the next two years.

Pressures on NZ growers to minimise food waste and strike a greater balance between supply and demand don't just stem from domestic regulatory pressures in areas such as freshwater management, but because our global competitors face them too.

"If we can prove that we're more efficient and actually outperform our competitors, we're in a stronger position comparatively."

Holgate's appointment was made in line with a global focus by Rabobank on boosting food security. Here in NZ, he's charged with developing and driving the bank's strategies and initiatives in this regard.

"That's about ensuring our clients and the (agribusiness) sector make decisions that ensure they are fit for the future world they're moving into, which is likely to be quite different to the world they are operating in now."

"We need to tackle the twin issues of ensuring global food security for a growing population, whilst also reducing the impact that producing food has on the environment/climate."

"We know this requires changes to how food is produced, and how we consume food – but an important (but often overlooked) part of the solution is minimising the amount of food waste – i.e., food that is produced, but ultimately doesn't end up being consumed, for various reasons."

We're all part of the food supply chain from the producer to the consumer.

Blake Holgate

At the macro level, inadequate infrastructure or systems result in food losses during the transportation and storage stages, as well as a misdirection of food supply, creating food surpluses that can't be utilised where it is needed.

"Rabobank believes getting a better understanding of the scale and drivers of this issue will help inform solutions to help address it."

"Globally we have to feed a growing population and do it in such a way that it minimises the impact on the environment, That's going to impact how we produce food and consume it."

Holgate articulates a "we're-all-in-this together" approach to tackling food waste.

"Climate change and its impact on natural resources is something that's common to us all. We're all part of the food supply chain from the producer to the consumer, because it's not just the food that's being wasted – it's the resources and the time taken to produce the food which is lost."

We all have roles and responsibilities in creating a more efficient food supply chain, he says.

Domestically, many of the rules and regulations governing agriculture which are being written now will "really define what, where, and how we farm over the next generation", Holgate says.

"It's essentially requiring the sector to account for the environmental impact of their farming or growing."

Water quality management is the biggest of these, requiring producers to account for nutrient loss from their operation by mitigating or reducing their loss. There's an inherent opportunity cost in improving on-farm infrastructure or fencing waterways, he says.

"Lost resources from farming systems are better kept in, and there's an opportunity at both the individual and industry level, to build efficiencies into those systems to better understand the land's natural characteristics, and really drive how we can better map land use."

"This will also drive production efficiency through technological efficiency, and that's positive."

Holgate has no doubt NZ producers are up to the challenge of adapting the way they operate as he's suggested they need to.

"They've always been good at adapting to changing market conditions – in lots of ways that can be a source of competitive advantage – because we are free of Government subsidies that give false market signals."

"It's essential to adapt and respond to what's happening in the market because we don't have that same safety net that other countries have."

"During Covid we started to develop a range of markets globally. There was a period early on where the Chinese stopped buying our meat, and (while) they were our largest market, we were still able to direct that product into other markets.

"That shows the importance of diversification, and our ability to pivot and send these products to other markets or sales channels."

Holgate says the hard work NZ has already done in the past two years to adapt to a Covid-influenced world will be to varying degrees what our competitors have to grapple with in the future – even though it might not be to the same extent.

"Accounting for a greater proportion of the environmental impact of food production is something where pressure will come on our competitors from the markets, from society, from NGOs – so us tackling this now, and if we can do it right, is where our competitive advantage will come.

"In five or 10 years down the track we'll be operating farm systems, we'll be implementing practices, and we'll have technology that enables us to be really efficient as environmental producers of food."

Our throwaway culture must go

Mark Peart

The case for New Zealand to further rein in its food waste, despite the best efforts of many Kiwis in this area, is compelling and sobering.

Research commissioned by KiwiHarvest and Rabobank found we collectively waste 8.5 per cent of our weekly food spend, and puts the estimated value of food thrown away at $2.4 billion a year.

Prime Minister Jacinda Ardern says the trend needs to be reversed because at the same time we're throwing away nearly 3000 tonnes of food a year, many Kiwi families are struggling to put food on the table.

This is something KiwiHarvest founder Deborah Manning, who has built a nationwide food rescue and distribution network from comparatively small origins in Dunedin over the past nine years, is well aware of anecdotally – the research now having confirmed it.

Food rescues connect surplus, predominately fresh, food, with people experiencing hunger – thereby using one problem to solve the other.

KiwiHarvest is New Zealand's largest food rescue organisation, operating in both the North and South Islands.

It rescues food from farmers, growers, manufacturers, supermarkets, cafes, restaurants, and hotels, and distributes it to community organisations working at the front line of hunger for their food support programmes.

This food, considered to be waste and therefore worthless, have no value, is actually worth almost $60 million dollars, Manning says.

This is where KiwiHarvest comes in.

"It is because of the support we receive from partners like Rabobank that we have diverted more than 6 million kilograms of food from landfill and provided the equivalent of 17 million meals from rescued food for vulnerable people," Manning says.

It is because of the support we receive from partners like Rabobank that we have diverted more than 6 million kilograms of food from landfill and provided the equivalent of 17 million meals from rescued food.

Deborah Manning

In April, Kiwiharvest reached a milestone of distributing 6 million kilos of rescued food – enough to feed the population of Northland for a month.

Ardern says reducing food waste is important from both a community wellbeing and environmental perspective, and the partnership Rabobank and Kiwiharvest has developed is an important example of this.

The Government has a range of initiatives in place to tackle food waste including improving roadside collection of household food waste, working on a national definition of food waste, developing a food waste reduction target, and supporting food rescue projects.

Manning says food waste reduction offers multiple wins for improving food security, addressing climate change, saving money, and reducing pressures on land, water, biodiversity, and waste management systems.

She says the research Rabobank and Kiwiharvest commissioned provides insights into New Zealanders' attitudes and behaviour around food waste at the consumer level, and the findings identify opportunities to create change.

Agribusiness

Avocado the next superfruit?

Increasing our investment in science and technology could see us leading the world with new crops, Plant & Food Research CEO David Hughes tells **Graham Skellern** and **Fran O'Sullivan**

For some time now, kiwifruit and apples have led the New Zealand horticulture industry by developing billion-dollar businesses and exporting to all corners of the world.

Avocados have the potential to join that league and become the next super fruit — from New Zealand's exporting perspective — through increased investment in science and technology, says Plant & Food Research chief executive, David Hughes.

"What would really make a difference (to the industry) is to have more exemplars like kiwifruit and apples where a broad-based investment in science and technology was translated through to significant economic, environmental and social outcomes," he says.

"There's quite a few other sectors within horticulture where we could apply the same learnings. There's a set of quite interesting tier two crops in New Zealand which are more at the hundred-million-dollar level of industry. There's a capacity for those to be lifted up to the billion dollars."

Hughes mentions berries, cherries, hops, onions, potatoes and vegetable seeds as promising sectors, but plumps for avocados — nearly 3.8 million trays worth more than $110 million were exported in 2019-20.

"The avocado sector has been growing really strongly, and when you look at the approach taken to grow the fruit, we are a relatively small player in the world market — and I don't think anyone would say New Zealand is genuinely world-leading in the use of all science and technology on avocado.

"There's some great stuff that we could develop further. I'm not saying that the sector is not employing good practice; they are. But there's a real opportunity for avocado to go from being part of the mix to a genuine leadership position which we have for both apples and kiwifruit. We could be the envy of the world, as we are for those other two crops."

Hughes says a quite substantive investment was required to change the way avocados are grown and take it from business as usual to world leading.

"But it's within our grasp because we've done it before on two other crops. We have already broken the mould and doing things in a different way that other countries have not yet been able to emulate and copy."

Hughes says berries and cherries are a bit smaller in scale but they are growing quite fast. Onions and potatoes are the other two that interestingly are around the $100m scale, and there's some interesting opportunities there.

"They are perhaps less exciting than the fruit crops, perhaps not as sexy and having that immediate eye appeal that avocado has, but onions and potatoes are pretty exciting crops with lots of potential.

"Hops has a high degree of potential and there's quite strong growth coming from that sector.

"There's ample scope in all of those for substantive science and technology and a return on investment — "really, a quite spectacular return if you get it right."

New Zealand's horticulture exports grew in value by almost 300 per cent between 2000 and 2020, earning $6.6 billion a year and accounting for 11 per cent of merchandise exports.

Hughes says apples and kiwifruit are the leaders of the pack with $2.5b of growth between the two. New Zealand has been voted by an independent assessor for a number of years as having the world's most productive apple industry, with its renowned Jazz and Envy varieties. And there isn't another kiwifruit producer/marketer structure that works as well as New Zealand's.

"You see that in the marketplace with the premium prices charged for the New Zealand kiwifruit and apple products and the level of returns that come back. New Zealand is doing something right in its horticulture industry, particularly for those two really big growth sectors."

Hughes says Plant & Food receives a lot of international visitors wanting to talk about how the industry actually works and how it achieves the results it is getting.

> There's some great stuff that we could develop further. I'm not saying that the sector is not employing good practice; they are. But there's a real opportunity for avocado to go from being part of the mix to a genuine leadership position which we have for both apples and kiwifruit.
>
> David Hughes

"My point of view is it's actually a really complex integrated thing. There's no single silver bullet. You're unlikely to spend a trip here and see, 'ahh, there's the magic secret; if only we had one of those, our industry would be miraculously changed'.

"And certainly, from a science or technology perspective, both the apple and kiwifruit industry have been investing heavily in science and technology for a long time. It plays out at all levels, right across the industry, from the proprietary varieties that are grown, the rootstocks they are growing on, the way the orchards are managed, all the way through to cool stores. It actually ladders up into a very sophisticated growing, marketing and distribution system and it's the way they mesh together that generates the results."

Hughes says green kiwifruit is attracting an orchard gate return of about $60,000 per hectare, whereas gold kiwifruit is up at $160,000 a hectare.

"They are pretty much identical vines as you look at them from a distance, growing on the same structures and being managed broadly the same way. They are generating, for example, $100,000 per hectare and there's close to 8000ha of licensed gold kiwifruit production.

"That's $800m of gold kiwifruit value creation every single year. So, we'd be pretty happy if we produced a unicorn, billion-dollar industry every year — well, the kiwifruit industry does it. It's about that level of genuine value creation all year and every year which is a pretty impressive feat.

"And there's some great stories in the apple sector, as well. Rockit apples usually catch people's attention because it's a cute little apple. It's a pretty exciting commercial story, too, on how they've grown that company from nothing to significant value quite fast," says Hughes.

At present there is plenty of discussion about rejigging the innovation system to capture greater future value, and where Crown Research Institutes fit into the structure.

Hughes says one of the hallmarks of great Science, Development and Innovation (SDI) systems around the world is self-belief and self-promotion. "You see it in Israel's Start-up Nation, you see it in the Dutch Food Valley, and you see it in Silicon Valley. We need to emulate these exemplars in both our internal dialogues and our external positioning.

"We need to stop writing reports which start by listing all the things that are wrong with New Zealand and our SDI system. Instead, we need to celebrate where we already lead the world and present a confident, uniquely New Zealand take on a national SDI system."

Plant & Food believes a National Science Strategy should be set by a three-way coalition of Industry, Government and Research. Each of these groups should be empowered and enabled to act on the agreed strategy, and this would require changes in the funding system.

Hughes says there's a tendency in New Zealand for each of the players to go off and set their own strategy independently, and then all come together and argue whose strategy should trump others.

"I think we ought to be co-designing the national strategy for these sectors. The Dutch have their triple helix model where they actually bring together senior people from industry, government and science to jointly set national priorities.

"It's about people genuinely getting around the table and having the debate, committing to it and bringing the resources of their organisation and the broader sector.

"If we could get to a sort of co-development, co-commitment approach to strategy setting for some priority areas, I think it'd make an enormous difference for us. And for New Zealand, I would make it a quadruple helix, because I think we need Māori sitting at the table as well. They are a very significant part of the industry with interests in crops."

Hughes says there's a lot right with horticulture and there's a lot that New Zealand can learn over the way science and technology is integrated with the commercial players.

"They invest in the science and technology, the Crown Research Institute gets it done, and together we share the benefits of the value that's been created," says Hughes. "We use some of the money that's generated to reinvest and create more value — it's a sort of virtuous cycle of investment driving value. And, for me, that's a great exemplar of how science and technology, generally, could be creating much more significant value for New Zealand."

● **A breakthrough 400 million years in the making, B30**

Agribusiness

A platinum level of farming practice

Dana Muir sees it as a blessing that she gets to sit in the finance world and gets to look at all of the great work going on in the sector.

At a Fieldays panel Muir – who is Head of Natural Capital at BNZ – said there's a lot that needs to done to meet our obligations on climate change and all the environmental, social and governance elements.

"We've been observing a lot of work going on internationally, defining what sustainable agriculture is.

"We all know consumers are starting to demand higher environmental, social and governance credentials in food, fibre and the fashion they consume.

"But we're seeing the exact same thing in the investment space.

"Investors are looking for responsible investments, they're looking for investments where the ESG credentials of that business are greater, and Covid has accelerated that as well."

Muir points to the pool of farmers and growers that are really leading the charge and striving towards that "platinum level of farming practice and wanting to take the rest of the sector with them".

> It's about looking at how the finance sector can – drawing a really long bow here – but be a conduit to the New Zealand Inc story.
>
> Dana Muir

"Finance's role is going to those top 25 per cent of farmers – or whatever the number is – and say to them, 'If you keep driving forward with really ambitious, measurable, environmental, social and governance goals in your business, can the finance sector actually come in and offer a carrot and not a stick to help you along the way?"

An example of this is the deal with BNZ struck with ethical dairy investor Southern Pastures which has entered into a three-year $50 million sustainability-linked farm loan which the bank has syndicated.

Southern Pastures, owner of Lewis Road Creamery, will receive financial incentives for meeting new water quality and biodiversity targets and for achieving further reductions in its already low on-farm carbon emissions.

Achievement of the targets will be directly linked to lower loan costs.

Says Muir: "Basically, we sat down with them and we said, 'Okay, let's get together.

"You guys tell us what some really ambitious goals are within your business, from either an environmental point of view, a social labour practice point of view or a governance point of view'."

"They chose the environmental space, and we said, 'right, let's set these goals together and if you can achieve these over the life of your loan, then, basically, there'll be an interest rate incentive for once you've met those targets'.

"It's about looking at how the finance sector can – drawing a really long bow here – but be a conduit to the New Zealand Inc story.

"Be a conduit to that traceability story and how we are lifting our game from a sustainability point of view."

Dairy's labour shortage doubles

Agribusiness
Graham Skellern

GoDairy campaign relaunched to attract young Kiwis as vacancies grow to 2000, writes **Graham Skellern**

There was some relief on the dairy farms around the country when the Government recently made an exception at the border and allowed 200 workers, most of them skilled, to enter the country.

But the number still wasn't enough to solve the increasing labour shortage, particularly in the south in Canterbury, Otago and Southland, with a total of 2000 jobs that needed to be filled immediately. The shortage has actually doubled over the past 12 months.

A day after talking to industry group DairyNZ chief executive Dr Tim Mackle about the labour pressures on the farms, the news came through that 150 skilled workers and their families will, from the end of June, spend two weeks in managed isolation and quarantine before taking up management roles.

They will be joined by 50 workers in dairy assistant jobs, and the much-needed labour is likely to come from the Philippines, Sri Lanka, Eastern Europe and South America.

Mackle said the border exception for dairy workers was a step in the right direction – "it's a nod to the cause from the government, but we are 2000 workers short and we need them from overseas as well as New Zealand.

"We've still got a big job ahead."

This time last year the dairy industry, at the start of the new season, had 1000 jobs available.

Then, DairyNZ realigned its GoDairy campaign to attract career-changers into the industry.

Rightfully, DairyNZ thought there would be a demand from people already ensconced in the workforce but had lost their existing job through the Covid pandemic. It didn't quite pan out that way.

"Our thinking was to attract career-changers young and old, but we didn't get any more than normal," said Mackle.

"With dairying you can grow your own business and craft your own destiny," says Tim Mackle.

"Everyone expected unemployment to reach 9 per cent by the end of last year and it finished up half of that. There was still strong demand from other industry sectors, such as construction.

"The numbers weren't stacked in our favour. I guess it was hard to up sticks and move south from Auckland – that was a big call for some people."

DairyNZ has refreshed and relaunched its GoDairy campaign, with an accent on digital, to promote dairying as a career of choice and attract younger people, aged between 18 and 25, into the industry.

"We had to stop and rethink the parameters of the campaign," Mackle said. "We will focus our efforts on young people and getting more Kiwi workers on to the farms.

"Our sector has a great story to tell including the lifestyle and career opportunities, competitive remuneration and being part of close-knit rural communities.

"Working in an office is not for everyone, and the wonderful thing with dairying is that you can grow your own business and craft your own destiny," Mackle said.

"One of the challenges we face is that there is not enough advocacy from parents, teachers and career advisers, and that's sad. We hear too often that 'farming is for kids who aren't so bright'. That's not the case – you have to be across a lot of issues in farming."

> Retired farmers have gone back into the milking sheds, or present staff are just working longer hours and toughing it out.
>
> Tim Mackle

The starting wage in the dairy industry is an average of $48,000 and workers can move quickly to a farm manager's role paying upwards of $78,000 a year. Accommodation is provided and plenty of on-the-job training is available.

"The number one thing (farm) employers are looking for is attitude and not skills per se. People can be taught the skills," said Mackle.

When the Covid pandemic set in, about 40 skilled farm managers were visiting families overseas, leaving their belongings behind, and couldn't return to New Zealand because of the border closure and the complications of meeting entry rules.

They are expected to be the first in line to re-enter the country and return to their work under the border class exceptions, which included 50 veterinarians.

Agriculture Minister Damien O'Connor said the dairy and veterinarian sectors were facing workforce pressures and these border exceptions will go a long way to relieving those pressures.

"What we have also made clear to sector leaders is that we need to ensure there is a strong incentive for New Zealanders to take up entry-level roles and develop careers in dairying.

"The Government and food and fibre sectors have been working hard to mitigate worker shortages by training and upskilling New Zealanders, but we know that takes time," said O'Connor. "Dairy managers and vets have specialist skills developed over many years, which we can't replicate overnight. Migrant dairy farmworkers will supplement the domestic workforce and provide critical support," he said.

Farmers bringing workers through the border must meet managed isolation and quarantine costs and pay them two weeks' salary while in isolation. They must offer a pay rate of at least $92,000, 1.75 times the current median wage, for an assistant farm manager and second-in-charge roles.

They must also offer a pay rate of at least $79,500, 1.5 times the current median wage, for dairy herd managers.

O'Connor said border exception spaces were limited and demand may outstrip supply. "Government will work closely with industry to ensure that together we prioritise those employers located in acute need areas or employers that have gone above and beyond to support the sector and recruit Kiwis into roles over the last year."

Mackle said retired farmers have gone back into the milking sheds to help fill the labour shortage – or present staff are just working longer hours and toughing it out. "We do have concerns about people's welfare – as well as animal welfare and environmental performance."

The $20 billion dairy industry employs 34,000 people and each year relies on more than 5000 migrant workers, two-thirds of them arriving on temporary visas and up to 40 per cent of them working in the South Island.

The labour situation has been compounded by the uncertainty of updating visas. Mackle said the processes have been on hold since Covid-19 struck. Temporary one-year visas were rolled over last September, and there's a longer waiting time for three-year visas.

Several hundred workers have been in New Zealand for six to eight years and have enough points to qualify for residency – but they have been waiting up to two years to get their residency processed and signed off.

"We do need to hang onto these skilled workers, as well as attract more Kiwis into the industry, and we are calling on the government to expedite their residency so employers can have more certainty," said Mackle.

The processing delays have caused some of these workers to look towards Canada. "We do have some leakage to Canada," said Mackle, "because the rules for entering the country are more relaxed than New Zealand's. They work here for three years, obtain the skills, and get into Canada just like that."

Agribusiness

No one has the answers, yet

Sustainability is valued by New Zealand's international dairy customers, says Fonterra's Kelvin Wickham

Agribusiness
Bill Bennett

"A lot of people thought sustainability went away in Covid times, but that's not correct. It is absolutely back and in the forefront of most of our major customers' minds", says Fonterra's Kelvin Wickham.

Amsterdam-based Wickham is the dairy co-operative's chief executive officer for Africa, Middle East, Europe, North Asia and the Americas. His role covers consumer, foodservice and ingredients products. He also has responsibility for the NZMP ingredients business.

It's a job that in normal times would involve considerable travel. Yet Wickham arrived in Amsterdam early last year on the first day of lockdown. He says there has been some kind of lockdown in place for the last 15 months and things are only now opening.

Open means travelling within the European Union, the UK is still off-limits and so are the other markets where Fonterra operates.

"The markets I'm working across, from the Americas, through the Middle East and Asia, they've all had their moments. The wonderful thing about food and dairy is that we're an essential industry in most locations and we've managed to keep the supply chains going, but not without difficulty.

"We've had people sleeping in factories in Saudi Arabia. We've had quarantines where we have taken all the vulnerable people out. In places like Brazil and Chile, the sheer number of people who got Covid means you have to manage through that. We're out of the worst in the current phase. We've managed to navigate through these supply chain disruptions and it has been fantastic to have a New Zealand supply chain that is open to the world."

Looking at Fonterra's business-to-business customers he says: "Household names like Nestle and Starbucks have been very public. They've been putting out reports and talking about their goal to be net zero carbon by 2050. That comes back straight to their suppliers because as much as 90 per cent of the footprint of their brands that you see on supermarket shelves are outside of their control.

"Then you have the wider issue at the government level. Governments are looking at sustainability across the whole food chain."

The question for Fonterra is how to engage with the issue.

Wickham says New Zealand is in a unique strong position because the carbon footprint per litre of milk produced here is around a third of the global average. That means we are 70 per cent less than the average and about 45 per cent less than major world milk producers.

"This makes Fonterra quite interesting to talk to if you are a global multinational and you're looking to reduce your carbon footprint. You can automatically take your footprint down for your ingredients."

Big multinational food companies like to take provenance right back to the farm gate.

"In some cases, they want to go beyond the farm gate. That is something the dairy co-operative already does and that gives Fonterra an advantage. It is not something intermediate dairy traders are able to do.

"Fonterra has another value proposition for the market. We combine New Zealand grass-fed, New Zealand cared for animals and genetic modification free. Customers are willing to pay a premium to be able to use this in positioning on their brands. This has helped us get a 50 per cent premium on a highly functional protein that's ready to mix for medical use," he says.

> Fonterra has another value proposition for the market. We combine New Zealand grass-fed, New Zealand cared-for animals and genetic modification-free. Customers are willing to pay a premium to be able to use this in positioning on their brands.
>
> Kelvin Wickham

"It is easier to get a value premium for a product like dairy when you can make hard claims. Say the product is organic, you need a recognised agency to back the claim.

"Soft claims are along the lines of 'New Zealand farmers provide better animal care'. These are still useful for getting a premium, but they are not as powerful as hard claims."

Wickham points to Fonterra's NZMP Carbonzero-branded organic butter as proof of the efficiency of hard claims. It is certified as zero carbon and is sold as an ingredient to businesses in North America.

The certifying company traces the product from the farm, through manufacturing, distribution and even the way the packaging is disposed of by customers. This has the opportunity for a quite significant price premium.

Many of Fonterra's multinational partners aim to meet their carbon goals, which are in line with targets established by the Paris Climate Accord, instead of resisting change. The company is getting there now with its ingredients because of decisions taken some time ago.

"New Zealand milk output is not growing, but global consumption is," he says. "That means the opportunity for us is to improve our portfolio mix over time.

"Not all customers in all markets are looking for the same things. How we segment customers is important. It's the same on the consumer side of the business; there is no single consumer need or demand. There are markets where people are in the 'me' phase. These people do care about the environment and whether animals are pasture raised, but it is more about 'me and my family'.

"There are other markets where people are in the 'we' phase. They take a wider view and are concerned about the impact of farming on water, environments and the like. The question is tailoring and supporting brands across these markets. We need to embed sustainability into the different offerings. This is something we are working through now."

In practice this means that the branding and marketing support for a product line can vary from market to market to cater for different sentiments.

One of the frustrations in the dairy industry is a widespread misunderstanding of the nutritional value of milk compared to the plant-based alternatives.

"It misses the point about the nutrient density of milk. Milk is a high-quality protein. The amino acid profile of milk versus some of the low-protein vegetable-based ones is not in the same league.

"I think the dairy industry globally needs to do a better advocacy job about the nutrition value of dairy and why it should be at the table as part of the sustainable food systems of the future."

The challenge in this area is that it is hard for an organisation like Fonterra to communicate technical information about the bioavailability of milk protein to consumers.

"We're doing the science and we're working with scientific bodies and regulators. If you look at the back of an almond milk product, you'll see it has about 0.8 per cent protein. It's three times the price, there is nothing in there and its carbon footprint is worse, but that's completely lost on consumers who think they are doing the right thing for the planet."

Another challenge facing Fonterra is broader greenhouse gas issues. Wickham says the co-operative is now working across the dairy industry to encourage wider improvements in greenhouse gas emissions. The high-level view is that if everyone were to adopt best practice the emissions would drop considerably.

In some ways this is harder for New Zealand producers because, on average, our emissions are already at a third of the level found elsewhere. The positive part of this is that we are starting from a better place than other dairy producing countries. The negative is that each extra step is progressively harder.

Most of the climate impact focus is on carbon emissions — when carbon dioxide is released into the atmosphere. Yet so long as there are animals in the picture, there will always be another greenhouse gas: methane.

It is unlikely methane emissions will ever get all the way to zero because it is produced so long an animal is alive. It is formed as they breathe and burp.

Wickham says this is a hard discussion to have. It doesn't help that, unlike carbon dioxide, methane is a short-lived gas. This means you don't have to get it to zero, instead there is a need to reduce the amount produced. Yet, if Fonterra and the dairy sector can solve methane emissions it would cut as much as 20 per cent from New Zealand's total emissions.

Fonterra is exploring ideas such as using natural fermentation to reduce methane. Its scientists have developed a kombucha-like treatment which it calls Kowbucha.

This approach is promising because the treatment helps inhibit the micro-organisms in a cow's gut that produce methane.

Researchers are also looking at changing animal diets, feeding cows plantain or other foods.

Wickham says: "We don't have the solutions today. Around the world no-one has the answers yet.

"It's a huge challenge."

Agribusiness

Fieldays plays host to

Entrepreneurs and inventors line up to make agribusiness easier, greener and more profitable

Agribusiness
Glenys Christian

Cropsy's co-founders, Ali Alomari and Leila Deljkovic with one of the units that monitors vine health.

Horticulturalists were well catered for at Fieldays with a range of different innovations on show to save them time and money. Many applied new and developing technology to tasks which have proven time-consuming and labour intensive in the orchard or glasshouse, mirroring some of the innovations which have long been used in the post-harvest and shipping stages of different crops' journey to markets domestically and around the world.

Auckland-based Cropsy Technologies won both the Early Stage Award and the Young Innovator's Award. Co-founders Leila Deljkovic and Ali Alomari, attended Auckland University, graduating in 2018 as computer system engineers. But seeing a gap in the information vineyards had to work with when it came to how their crops were performing they set up Cropsy with Callaghan Innovation funding and now employ six staff, including two additional co-founders Rory Buchanan and Winston Su.

"We're poised for growth. Our mission is to deliver our tech to growers globally," Ali said.

The company's unique hardware means it can deploy high-accuracy artificial intelligence (AI) in real-time to let growers monitor every plant. And with hardware that preserves real-life colour and texture in images that other technology isn't able to produce, a data-rich map can show growers information which was impossible to achieve before; locating disease clusters, fruit counts, dying or missing plants, just as a start. The compact vision system with machine learning that looks out for anything that's wrong with plants can easily be attached to the front of a tractor. So crop losses can be minimised, estimated yield information can be supplied and any replanting required can be carried out with precision.

"We're creating technology that's accessible to growers and easy to use, which is a big deal. It breaks down barriers to adoption which so many other technologies that exist now have encountered," Leila said.

> We're creating technology that's accessible to growers and easy to use, which is a big deal. It breaks down barriers to adoption.
>
> Leila Deljkovic

"And the technology is still evolving."

Cropsy has completed its first season of trials with vineyards in Marlborough and Hawke's Bay and looking at the possibilities for expansion in the pipfruit and kiwifruit industries where pruning, for example, could easily be optimised. "Imagine if PSA could have been detected in kiwifruit before it spread so rapidly?"

Cropsy is seeking pilot partners for commercial use of the technology next season.

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Agribusiness

innovative solutions

continued from B16

PlantTech was showing off its application of AI to the kiwifruit industry in order that growers and marketer Zespri are able to make better decisions about the fruit's crop. Zespri usually undertakes two weeks of surveys in January and February to estimate the coming season's kiwifruit crop. But there have been limitations as the small sample collected isn't representative of fruit size through the whole orchard.

PlantTech saw three challenges which needed to be addressed; identifying individual kiwifruit and measuring their size, estimating distance from the camera to work out exact dimensions and estimating the weight of each based on the two-dimensional images. By applying deep learning, the exact boundaries of each fruit in the images could be worked out, and with two cameras in operation fruit position could be triangulated so 3D positioning was possible. Then an AI model was used to learn how to estimate kiwifruit weight from the images produced. The system was used on both Green and SunGold varieties of kiwifruit and validated by comparison with actual fruit weight where there was only a mean average error of seven grams, or six per cent.

So far the system has been used on over 20 million pieces of fruit with images processed in real-time. That means Zespri could scan one hectare of kiwifruit orchards an hour, data could be processed overnight and reliable size profile information could be produced the next morning. As well as better planning for accurate packing, coolstore capacity and shipping it would significantly reduce the risk of under-delivery or over-supply to markets.

PlantTech's chief executive Dr Mark Begbie with a tablet on which kiwifruit growers will be able to check the firmness profile of their crop.

PlantTech's entry in the Innovation Awards was a new way the measure kiwifruit firmness to determine harvest time. In the past using a sample of fruit from an orchard block to see whether pickers could move in, meant it was destroyed. But the company saw that advanced machine learning could be used to translate an acoustic signal from an eFast prototype developed by Eurofins to a firmness index so this could be avoided. And after trial work, it believes there's also the potential to measure fruit after harvest such as where there could be commercial value in preserving fruit condition.

The company is now looking at how to get the technology out to growers who it believes in the future will be able to use an Ipad to calculate the size of their crop as it develops. It's also involved in work with New Zealand Avocado gathering rich data sets in order to estimate crop size and detect early signs of pest and disease attack. It's partnered with Scion using similar technology in the forestry sector and is at the early stages of working with tomato and capsicum growers to add extra value through early disease detection.

Dr Mark Begbie, the Tauranga-based company's chief executive, believes there could be benefits across the whole agricultural sector from the technology with so-called unproductive land being mapped and recognised for its uses for water retention and retaining biodiversity, he believes.

"We're starting to see it can deliver value to the wider sustainability scenario."

A father and son engineering combination has come up with Tractos, a retrofitted unit which allows mowing and spraying to be carried out without a driver.

Dave Walters is a Christchurch mechanical engineer who has been involved in design development work for the last 30 years. His son, Sean, is an electrical engineer based in Auckland and together under company name Machines at Work they were looking for innovative growers to be part of their early adopter programme. The retrofitted Tractos unit sees the orchard in 3D whilst moving, reacting to and avoiding obstacles such as fences or canopy frames. It's been developed over the last eight years after they initially looked at designing a driverless pasture measuring machine for use by dairy farmers.

"But then we saw it was better for

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Ideas that cross the border

The Growth and Scale Innovation Award was taken out by IGS Limited, which is based in Scotland and the United States so couldn't attend Fieldays because of border restrictions.

It's developed growth towers, a vertical farming system which uses the internet of things and a three-tier intelligent system to control all aspects of plants' growing environment. It promises only half the energy usage of traditional covered crop growing systems as well as using 80 per cent less labour.

Amongst other companies represented at Fieldays by the British High Commission was Inmarsat which services the New Zealand market from Australia. There it's combined with Farmbot Monitoring Systems, to supply rugged self-powered two-way connection devices in remote locations. Hardware, sensors, satellite and cellular connectivity are all combined in an end-to-end solution. The corrosion resistant unit doesn't require a technician for installation and its dashboard can be used by a number of people at once to perform tasks such as monitoring water levels, finding pump issues or keeping an eye on diesel tank levels. Staff can also use it to send an immediate distress signal.

At the Enterprise Ireland stand innovations ranged from the small to the large with both available in this country.

Tailpainter was launched at the end of last year by Agrify Solutions. Its invention came about when an Irish dairy farmer mentioned his problems with tail painting to his brother in the corporate world. Together they came up with the lightweight, adjustable tool which can pivot up, down, left and right for the most comfortable position for the operator. The company's Daisy Paint is low cost, water-based, has a bittering agent included so heifers won't lick it off and the packaging is recyclable. It's distributed by Fortis and available either online or through Farmlands stores.

Above: Keenan nutritionist, Alejandra Vergara, with the InTouch system on the back of one of its feed wagons. Right; Misty Manu from Fortis with the Agrify Tailpainter.

Keenan, who have sold their feed wagons in New Zealand for over 20 years, had their computerised InTouch mixing system on show.

It allows farmers to change their cows' diet by logging in and selecting one of a choice of 200 different feed rations with the machine automatically adding the amount of water and silage required. Data is drawn on from one million cows on almost 10,000 farms in 25 different countries to determine the most efficient diet which is then mixed in the wagon.

The system complements pasture feeding, allowing farmers to ensure the best diet for their cows at any time during the year when feeding supplements is required. Around 60 New Zealand farmers are currently using the system.

Robot harvest tip of the crops

A robotic asparagus harvester which has been under development for some years by Waikato University is being eagerly awaited by growers struggling with labour shortages. It was first thought up five years ago with the research work gearing up two years later. A PhD student is about to submit a thesis on the work shortly.

Hin Lim, from the university's school of engineering, said the unit had been developed with Tauranga company, Robotics Plus. In 2019 the first version of the machine was trialled in California in the off-season for the crop's production here. Then over the last two years Waikato asparagus grower, Lewis Farms, producers of Tender Tips Asparagus, as well as the New Zealand Asparagus Council have been involved in local field trials at Newstead and Matamata.

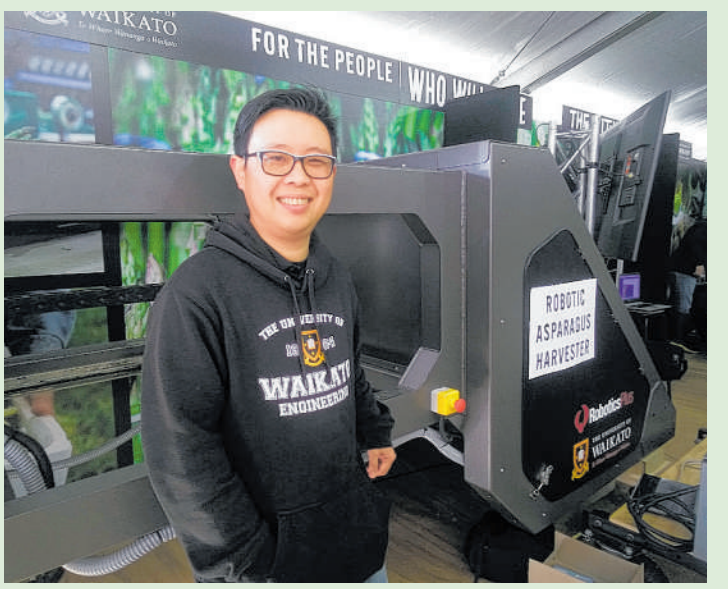
"The growers were happy with it but we wanted to make sure the vision system worked well," he said.

A unit under the machine detects individual asparagus spears, activating a knife to cut them to be collected on a conveyer belt. The first arm used to cut the spears was found to operate too slowly so a new one was fitted to speed the action up. And it was also found that the technology worked much better with a flat rather than mounded growing bed, meaning some flattening out was required before harvest.

It's hoped the machine will be commercially available within a couple of years.

"We want it to be self-driving so that it will slow down where there's a dense part of the crop and speed up where there's not," he said.

"Growers being able to send it out to harvest their paddocks by itself is the plan."In the future, the same technology might be able to be applied to harvesting broccoli.



Hin Lim from Waikato University's school of engineering with the robotic asparagus harvester.

Agribusiness

All-seeing eyes and barking drones

One company changed tack from sheep to dairy cows as part of its innovation journey.

Dunedin's Iris Data Science took part in the Sprout Accelerator Programme several years ago, developing a facial recognition system for sheep, in order to prevent rustling and monitor animal behaviour.

"We thought the market would come," said managing director, Greg Peyroux. "But Sprout taught us to look for painkillers rather than vitamins."

So during last year's lockdown he made a lot of phone calls to find other areas where machine learning might find a use.

"Lameness came up top."

So the company developed its OmniEye locomotion scoring system which uses a CCTV camera mounted on a post near the exit race from a milking shed. It assigns each member of the herd a locomotion score from 0 to 3, ranking lameness with 3 meaning it needs to be drafted for treatment immediately. So farmers will receive an alert to that effect at the very next milking.

Four vets and two lameness experts, including Neil Chesterton, who is well-known in this field, ranked cows in order to build the deep knowledge required for the machine learning required. So now the images from the camera are sent to the Cloud to be transformed into 3D. By recording 27,000 data points for each animal as well as referring to a video file, algorithms are built up so comparisons can be made with cows moving normally.

It's estimated lameness could cost some farmers $50,000 as lame cows' milk may need to be withheld while they're treated and they may be culled from the herd at an early age.

The technology has been trialled on six farms already with the call going out at Fieldays for a further 50 farmers with rotary milking sheds and a good internet connection to take it to the next stage. "We want farmers to co-design our next tranche of models with us," said Greg, who co-founded the company with lead data scientist, Benoit Auvray. Overseas countries are already interested as well as goat farmers and horse owners locally.

Plans are under way to release different adaptations to record cows' body condition scores within the next six to nine months. And the company is also working on developing deep learning pasture quality prediction software. It's also joined with AgriGanics to create an artificial intelligence (AI) system to optimise soil health.

Murdoch Rutherford from Ferntech with its barking drone (above). Greg Peyroux, the managing director of Iris Data Science with the OmniEye camera for measuring lameness in cows.

Drones have put to a new purpose by Auckland-based company, Ferntech, with its barking drone on display. It can fly for almost 30 minutes on one charge, and be used up to eight kilometres away from the operator. It comes complete with a high-resolution thermal camera to make finding stock easy and its speaker can emit a recording of a dog barking to move them rapidly to where the farmer wants.

Up to 500 are already in operation around the country on small and larger farms with Ferntech developing more uses more the machines supplied to it by Chinese company, DJI. It also markets field mapping or surveying drones equipped with a multispectral imaging array made up of six cameras to collect data which can be used to identify weeds or crop diseases as well as before and after information on crop treatments.

Spraying drones which have payloads of up to 30 kilograms and a spray width of up to nine metres are able to spray chemicals evenly and accurately. Not only is there less wastage, they are operated over land that would be challenging for large machinery to access.

Two animal welfare-oriented devices were on show in the Innovation Hub.

Numnuts is a tail docking and castration device for lambs, marketed by Timaru company, Agilis. Developed in Ireland and tested in Australia the tool allows the operator to apply Elastrator rings over the animal's tail and scrotum together with an injection of local anaesthetic.

Also on show was the soletech dehorner, developed by Massey University final year vet student, David Sole. It will be on the market next year promising faster, easier and more gentle dehorning of calves with less physical labour for vets.

He's also developed the soletech fetotomizer, a gentler way to remove calves which have died in utero from their mothers.

It won first place in Grand Ideas, an innovation challenge at Massey University last year.

Fieldays plays host to innovative solutions

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orchards with the repetitive tasks they have to carry out," Dave said.

"People are definitely looking for a solution and with retrofitting it's at the right price."

A Cambridge blueberry grower has been developing the technology further with them using it on a mower on his 40 hectare orchard over the last year. The unit could also be used on a sprayer, giving the added advantage of keeping workers clear of any spray residue.

BA Pumps and Sprayers, which is based in Cambridge, was showing off the BA Smart Sprayer, powered by Smart-Apply® which provides a more efficient spray application and more data for growers. It was developed and field-tested at the USDA National Institute of Food and Agriculture over the past decade, where it's been shown to reduce spray consumption and reduce up to 87 per cent of airborne drift, a big environmental benefit.

The system uses LIDAR sensor technology to detect specific architecture of the vine canopy, recording the height, width, spacing and density of each plant it passes. It can be retrofitted to most vineyard sprayers. Key differences to other systems are no uploading of vineyard maps is required and the data collected is available in real-time.

Nick Pickering, right, and Mark Graham with the Zespri kiwifruit survey robot.

"We need a more sustainable approach so let's do it smarter," said operations manager, John Dixon.

Vineyard trials by Pernod Ricard showed input savings and better data collection via a user-friendly, tablet-based control platform. There could be future uses as a scouting and reporting tool and there's already been a lot of interest from Hawke's Bay pipfruit growers.

A kiwifruit survey robot has been developed in a collaboration between Pollin8 founder, Nick Pickering, a researcher and lecturer at Waikato University, and Zespri. He has a background in avionics and said the technology involved is now affordable enough to be able to use in orchards. A prototype of an autonomous machine is planned within the next six months, certified to aviation standards. It will able to navigate its way safely through an orchard due to an onboard camera. Sensors will be able to count flower numbers in spring as well collecting data to build leaf index information, determine fruit size and potentially give an early indication of any pests and diseases.

"The labour shortage is a huge driver for innovation, and it's only going to get worse," he said.

Growers wanted to improve their margins and save money.

And with a new generation of growers staying on orchards and getting involved in their parents' business they were more likely to adopt new technology.

Early on the first day of Fieldays, five growers had already signed up to trial the unit which is at present being towed through orchards while further fine-tuning takes place.

"There will also be the choice of adding more sensors on the one platform," said Mark Graham, Zespri's innovation leader.

This information could all be sent through to a kiwifruit grower on a map of their orchard, allowing them to send staff to a particular area, for example, to treat pests only where they were in large numbers.

On its first visit to Fieldays as part of Amazon Web Services (AWS) stand was Auckland company, WayBeyond. It split away earlier this year from Autogrow, where it was incubated as a start-up and now specialises in data, AI and plant science, concentrating on tomato growers.

It provides easy to use measuring and data storage solutions via FarmRoad, its farm management platform which lets glasshouse growers better understand the microclimate and what's happening with their plants.

Its Yield Prediction tool uses AI to get up to 95 per cent accurate tomato crops predictions one to six weeks from harvest. And its mobile Crop Registration app digitises what is for tomato growers a time-consuming manual data process of measuring 10 plants per area in a glasshouse every week using a tape measure, calipers and a clipboard to work out average plant and leaf length, stem thickness, flower numbers and fruit sets.

Interest in WayBeyond's innovation has so far come from large growers overseas but it hopes that in the future the local horticulture industry will be able to benefit fully from the available new technology.

Agribusiness

How to stay ahead of the herd

Glenys Christian

Dairy farmers visiting Fieldays could see a number of highly practical innovations to make their and their herds' lives easier.

The winner of the prototype section in the Fieldays Innovation Awards went to SpringArm Products for the invention of a water trough ballcock arm that won't break, but instead flexes under pressure, saving farmers water, time, money, and perhaps most importantly, stress.

Te Awamutu dairy farm manager, Ric Awburn, was sick of water troughs needing repairs so two years ago he decided to come up with a ballcock arm which simply wouldn't break.

He also realised it needed to be animal welfare friendly and to fit in with existing systems. He took the spring off the stand of one of his children's two-wheeler motorbikes and added it to a ballcock arm by chopping it in half.

"We've used these arms in troughs on our farm for 12 months and haven't had one leak due to overflowing troughs, a huge relief," he says.

"Water leaks waste valuable water, cause mud and flooding and incur extra pumping costs. We think the SpringArm can help stop that."

And that was exactly the feedback he received from the many farmer visitors to his and wife Marianne's Fieldays stand.

Halter, a fenceless farming company, was showing its solar-powered smart collar. This is fitted to a dairy cow and paired with a simple app that allows farmers to remotely shift, virtually fence and proactively monitor their cows' health, feed and behaviour.

Founder and chief executive Craig Piggott designed Halter with a vision to reinvent farming to benefit cows, farmers and land. By automating some of the most critical tasks in farming, it's unlocked a new way for farmers to work and live. It reduces both time and labour requirements, saving up to 20 hours a week, and increases production, animal welfare and sustainability standards.

The collars enable unprecedented connectedness to a farmer's biggest asset by collecting data at a rate of over 11 million data points a day, giving a highly accurate picture of herd health. That, combined with Halter's proprietary machine-learning algorithm, Cowgorithm™, creates a custom behavioural baseline for each cow. Changes to this baseline can show the farmer whether a cow is on heat or sick, sending an alert straight to a farmer's phone.

Farmers currently using Halter in the Waikato say it allows them to better optimise their herd's welfare by giving them the ability to focus on individual cows. They can split herds into multiple smaller mobs, grouping them by feed intake requirements, so cows receive precisely the right amount of feed to stay in the best condition. And running these multiple mobs doesn't mean more time to shift cows to and from the milking shed as with Halter, farmers can schedule the second mob to arrive for milking as the first leaves.

Craig Piggott (left) with a dairy cow wearing the Halter. Milking by Time (MbT) director, Josh Wheeler, in front of the timer.

Halter plans to expand to other rural areas across New Zealand later this year.

A simple but very time-saving idea came in the form of Milking by Time (MbT). It's billed as a milking shed row timer that helps farmers apply an efficient milking routine which is good for them, their staff and their herd. The large, easy to read digital timer display can be quickly fitted in herringbone or rotary milking sheds with the most efficient milking time set by a mobile app. This is a new approach to implementing the DairyNZ MaxT process which leads to shorter milkings, better teat health and less over-milking.

The display counts the time up or down, changing colour from green to red 30 seconds before the cups should be removed from cows' teats. By milking to a set time it's easier to train and maintain simple milking shed routines with cows, as a result spending less time standing on concrete and more time in the paddock eating.

The first prototype was released in February last year and since then around 40 farmers throughout the country using 20-aside herringbones up to 60 bail rotaries have trialled Mbt. They've reported efficiency gains of from 45 to one hour and 30 minutes less spent milking. Those new to milking don't have to spend time walking up and down checking as to when cups need to come off so can pay more attention to tasks such as teat spraying.

It costs $1400, is Apple and Android compatible and allows farmers to review data from up to 32 previous milkings.

Ingenious ways to outwit pests

Farmers are always looking for better ways to keep pests under control and there were two innovative ideas at Fieldays designed to deliver them just that.

Matt Way, founder of Econode, believes in empowering conservation with technology. He entered his SmartTrap for rats which he's trialled on Great Barrier Island for the last two years, in the Innovation Awards. It's a low-cost solution for monitoring traps in remote locations where it's hard to check regularly.

He'd worked in the oil and gas industries in Asia but moving to Great Barrier he linked up with Scott Sambell in a local initiative to help rid the island of one of its biggest problems. The wireless monitoring system they designed uses Low Power Wide Area Network (LoRaWAN) internet of things meaning it can be incorporated into most existing traps. The components are enclosed in a weatherproof case with four alkaline AA batteries giving years of power. When the trap is sprung a signal is sent to a base station using the radio network then uploaded to the internet so operators can be notified by email, text or smartphone.

It's already being used by a number of councils around the country and its circuit board used has been adapted by Auckland Council to monitor kauri dieback. He's also had a prototype of a bait dispenser on show which will squeeze out small amounts of a toxin over a two-week period, removing the need for it to be constantly replenished.

Shane Hyde from Kaeo, Northland invented the enviroMate 100 which can be programmed to deliver pre-feed or poison without any human involvement for up to 21 days. As it can target multiple species, trappers can cover a much bigger area.

It's NZ's first electronically assisted pest-control tool, thought up by Shane on the job trapping possums. He showed it off at Fieldays seven years ago, finding a business partner who helped commercialise it. Three years later his company, Ecoland, used the enviroMate 100 on over 400ha. Results showed a 52 per cent wax tag index (WTI) at the start and 7.5 per cent at the finish, a very successful possum control operation compared with a control area. Shane said not only is fur recovery in low-density possum areas made more economic but boundary control is dramatically improved. A single enviroMate100 can outperform 10 kill traps in the same immediate area, he believes. And its German manufacturing means it's very robust making it suitable for even the harshest environments.

Matt Way with his Econode SmartTrap.

Answers from info-tech

It's all very well installing the latest technology on-farm but increasingly farmers are looking for more efficient ways of collating the information generated to put it to greater use. In the Innovation Hub at Fieldays two companies were showing off their answers.

CropX was founded in New Zealand six years ago after initial work carried out by Landcare Research. It moved to Israel becoming a leader in soil sensing and agricultural analytics then in September last year it acquired Regen. This New Zealand company was founded in 2010 and specialises in cloud-based, precision effluent and irrigation decision support tools. Large South Island dairy farmer, Dairy Holdings, has been using the sensors for the last three years which are now available through CropX.

They're robust and low-cost, taking only five minutes to install. They'll then start transmitting information to the farmer's laptop or mobile phone to let them know, based on recent rainfall or irrigation, whether it's too wet to put more effluent on their paddocks, so they keep within the terms of their environmental consent.

Leaching of otherwise valuable nutrients can be eliminated, fertiliser use is cut, labour is reduced by not having to physically monitor soil conditions and perhaps most importantly there's the peace of mind of knowing exactly what's happening thanks to the clear graphs generated. The sensors are self-powered, using long-lasting rechargeable batteries.

Geo Data Solutions (GDS) based in the Bay of Plenty and Northland was showing how data from a variety of devices installed around a farm can be collated for ease of use. It's partnered with Australian company, Environmental Weather Systems (EWS) which specialises in the design and manufacturing of internet of things transmitters, including one which can quickly switch between satellite and cellular coverage.

Eitan Dan (top), general manager of CropX, with one of its soil probes. GDS (below) collates on-farm data for easy use.

Reliable telemetry technology can be retrofitted to existing systems and connected via the Iridium network which ensures service is available even in the most remote areas. A single dashboard can bring together information on effluent tank levels, soil moisture and from its automatic weather station so farmers can see at a glance their interaction. By simply logging in they are able to receive real-time information generated from sturdy sensors run through solar panels, which means they can be placed in hard to get to parts of their farm.

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The innovators' drive means

Our most profitable farming system has come in for flak, but, **Keith Woodford** says, we are finding solutions

New Zealand currently earns approximately $20 billion of export income per annum from dairy products. Meat from these animals is additional.

The simple reality is that dairy underpins New Zealand's export-led economy. Dairy is Number One!

Another simple reality is that the dairy industry has been struggling for social acceptance within New Zealand. There are multiple reasons for this. At the top of the list is the perception that cows pollute the water and create greenhouse gases. Both of these issues present big challenges. Then come issues of animal and human welfare on dairy farms.

If there were simple alternatives that could earn similar export earnings, then perhaps the dairy industry could indeed fade away. But there are no simple alternatives.

The reason that we have become the world's biggest exporter of dairy products is quite simple. On most of our flat and gently sloping land it is by far the most profitable farming system. That is a consequence of our temperate maritime climate, combined with soils that have major limitations for cropping systems.

The notion that New Zealand might replace dairy by becoming a big crop-producing exporter is naive. Our cereal growing industry goes back to the earliest days of European settlement. We can produce great yields but we have never been able to make that pay on global markets. And for those who understand the science and economics of agriculture, that is no surprise.

Intensive cropping

One of the challenges associated with intensive cropping systems is that nutrient removal from the soils is much greater than with livestock systems. Urban folk seldom understand that vegetable and cereal crops, remove far more nutrients from soils than do livestock systems, and these have to be replaced from somewhere.

On our better soils it is possible to combine cropping with a livestock phase, and this is exactly what we do. But the notion of trying to grow crops on other soils would be an ecological disaster. In New Zealand, we have been blessed in multiple ways, but we have not been blessed with the naturally fertile soils found in much of the Americas and also much of Europe.

The importance of soil type is illustrated by the photo of the Rakaia River taken from the air in early June (see photo, top right). The North Bank has skinny soils used totally for livestock and is a consistent green colour. In contrast, the soils on the southern side are much deeper as a consequence of wind-blown silt coming out of the Rakaia Gorge in Nor'westers. Those South-Bank soils have been used for mixed crop and livestock for well over 100 years, and hence the varied colours.

As for horticulture, yes, we will continue to grow our exports. Kiwifruit and wine are the standouts. Then come apples and a range of subtropical fruits. These are all making an increasing contribution to our export economy. But to think we can run our export economy on these crops is to misunderstand the enormity of livestock's contribution and the horticultural constraints.

A quick look in my family pantry shows tinned tomatoes that come from Italy and tinned apple slices from China. Both are Pams brand and I had to look hard to find the country of source. The Wattie's can of "four beans in spring water" was made in New Zealand from imported beans and local spring water. The canned apricots come from Spain.

Once upon a time New Zealand had its own apricot-canning industry but that disappeared with the building of the Clyde Dam and the arrival of Lake Dunstan.

Many decades ago, I played a part in the economic analyses that demonstrated how destruction of the apricot-canning industry would be one of the outcomes of making way for the dam. It was all about trade-offs.

As for artificial plant-based meat and dairy, there is a notion these can be produced by some magic laboratory processes. But there still has to be an energy source to feed the bacteria and related organisms. One such source is cane sugar. Another is supposedly hydrogen.

Some clarification about hydrogen is important. In the future, hydrogen may well become a means of storing energy, but it is not a source of energy. So yes, we could take the electricity currently generated at Manapouri and used by Rio Tinto Aluminium at the Tiwai Point smelter, convert it into hydrogen, and then use it to produce artificial meat and milk.

Recently, I watched a television programme where an influential new Zealander argued that Huntly electricity generation should also come from hydrogen. There did not seem to be recognition that the energy in the hydrogen would itself have to come from electricity in the first place. So yes, we could convert energy sourced from hydro or wind into electricity, then store it within hydrogen, then convert it back to electricity at Huntly. It reminds me a little of the nursery rhyme about Liza, Henry, and the hole in the bucket.

Comparative advantage

One of the wonders of both pastoral and cropping systems is the use of that infinite source of energy called "The Sun" through Nature's wonderful process called photosynthesis. The energy itself comes free, but of course there are costs in turning it into food for the dinner table.

One of the fundamental principles of economics is the theory of comparative advantage. This theory says that countries should produce the products for which they have a comparative advantage and then trade these for items where they lack that advantage. That is why New Zealand has always focused on pastoral products that suit the temperate maritime climate, while other countries focus on crops which grow best in continental climates.

Here in New Zealand, we will never be able to grow world-leading crops of bananas, oranges, soy beans, rice or even cereals. In some cases, our climate is totally unsuitable. In other cases, we can grow the crops but the economics are strongly against us. And very simply, we do not have enough of the top-quality soils that would be needed.

I trust that by now I have convinced at least some of my readers to the notion that there are no easy alternatives to our Number 1 export earner. Therefore, it makes sense to see what we can do to solve key problems. That requires us to move beyond arm-waving and generalities, and come up with specific technologies and systems that can transform the New Zealand dairy industry.

Composting 'mootels'

Currently, I spend a lot of my time working with a small group of farmers who are actually doing something about it. These people are what are called "end-user" innovators, taking new ideas and making them work in their own specific situations across the country.

The key innovation is the notion of "composting mootels" or "composting shelters". These two terms are essentially the same concept. We try not to use the word "barn" because the composting mootels and shelters are fundamentally different to every other type of barn. Also, in the New Zealand context, the idea of cows being enclosed in a conventional barn as occurs in Europe and the Americas is enough to start the blood pressure rising with anger and hostility.

The composting concept the way we are using it in New Zealand is very different to anything I have seen overseas. The mootels and shelters are open structures with lots of room for cows to move around and exhibit their normal social behaviours.

The key idea is that the farming systems are still very much pasture-based, with the cows harvesting their own feed throughout most of the year. But once they have a full belly, they can come back to the shelter and that is where they do most of their peeing and pooing.

In New Zealand, we will never be able to grow world-leading crops of bananas, oranges, soy beans, rice or even cereals. In some cases, our climate is totally unsuitable. In other cases, we can grow the crops but the economics are strongly against us.

The Rakaia River (top) illustrates how different soil types are suitable for different types of farming. Composting 'mootels' (left), allow cows to exhibit their normal social behaviour.

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dairy can continue to thrive

Unlike dogs and cats, cattle cannot be toilet-trained, but that does not really matter. The pee and poo combine with the bedding to start another of nature's wonderful processes called "composting". This generates heat, and as long as the bedding is tilled at least once per day, then the fermentation is aerobic and the moisture evaporates. The cows remain warm, dry and clean. They love it. And there is no smell, totally unlike other barns.

Duration-controlled grazing

In most parts of New Zealand, pasture does not provide enough feed in the winter. So, the cows have to be fed supplements. This can be crop or silage, typically fed adjacent to the shelter, or in troughs within the mootel.

Alternatively, the cows can still go out into the field to harvest their own winter crops, but they are much happier if they can quickly come back to the warm dry shelter.

The notion of duration-controlled grazing is fundamental to the environmental benefits.

With standard New Zealand grazing systems, the big environmental problem is the intensity of nitrogen within the urine patch as this is what drives nitrogen leaching.

The pee and poo patches are fundamental to nitrous oxide emissions. This problem can be solved with composting mootels and shelters. The main times when it is important to get the cows off the pastures for at least part of every 24 hours are autumn and winter.

I tell farmers that they should plan on removing the compost and adding new bedding once a year. But a farmer-led innovation that is currently occurring may well mean that in future we can keep the bedding for up to three years.

One of the Canterbury farmers that I learn from employs a sharemillker who has been on the farm for many years.

The sharemilker tells me that the winters have never been so pleasant. Even on a fine day, the feeding and tilling chores are all finished earlier than with the previous systems.

This year we are having a horrible winter in Canterbury and there are some envious neighbours.

Of course, building new infrastructure costs money.

The economics have to be worked out individually for each situation, but the farm accounts that I see, together with the physical performance, tell me that on the exemplar farms things are going very well. Benefits come from considerably less winter-feed required, better cow condition, well managed feeding transitions at calving, much less pugging damage to paddocks and increased milk production in the vat. An additional North Island benefit is summer-shade with cows then holding their peak production into the autumn.

Banks are currently cautious of lending for any infrastructure and that includes composting mootels and shelters. Most bank policy comes from the Australian headquarters. There is a need for some banker education.

In autumn and winter it is important to get the cows off the pastures for at least part of every 24 hours. Which is where the "mootels" come in.

Keith Woodford is a retired professor from Lincoln University who retains an honorary position as Professor of Agri-Food Systems. He now consults in New Zealand and internationally through his own company AgriFood Systems Ltd. He can be contacted at kbwoodford@gmail.com.

Research and development

I have referred already to the importance of end-user innovation, but what about the formal research and development (R&D) system within NZ?

The answer is that apart from a small grant to me from The Agricultural and Marketing Research and Development Trust (AGMARDT), the formal R&D system has yet to get involved. That may seem surprising, but those who understand the challenges of creating transformational momentum rather than marginal change will appreciate why that is the reality.

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My current AGMARDT project is setting out what we already know, what we don't know, and hence some needed R&D focusses.

My reckoning is that we know enough to move forward with confidence, but there is a great deal of work to be done if the technologies and systems are to be rolled out efficiently across broader industry.

Right now, it is the innovators who are moving forward and creating their own learnings. Then will come the early followers, followed by the late followers and then the laggards.

It is going to be an interesting journey, with lots of twists and turns.

Poo power — Biogas from dairy effluent

A prototype biogas system operating at a Landcorp-owned farm at Eyrewell, North Canterbury was well ahead of the curve.

In an early pilot study began around 2008, manure from the farm's cows was collected on a concrete pad outside the milking sheds, and pumped into a tank digester.

The gas produced was used to power a generator that provided around a third of the farm's energy requirements.

An arrangement with local retailer Genesis Energy meant that any excess electricity that is exported, got subtracted from the farm's overall consumption.

The BioGenCool™ system, designed and installed by Natural Systems Ltd, also instantly cooled the milk, which improves its quality and lowers power demand.

Natural Systems director Ian Bywater said the potential for biogas systems on dairy farms is growing fast, especially where farmers increasingly use barns to house cows during winter.

This not only boosts productivity by improving cows' welfare, it also enables 100 per cent of manure to be collected for energy generation during months that cows are inside.

There are environmental benefits to the biogas system also.

The digestate that comes out of the tank is very low in pathogens compared to raw manure, and is ready for use on paddocks as an effective biofertiliser.

This comes on top of the reduction in carbon emissions from using up methane.

"Farmers are realising that it's sensible to look at biogas energy generation — both to combat the environmental problems with dairy effluent, and because they're concerned with rising energy costs," said Bywater.

It's also a fast-developing trend in the United States, where biodigesters, use specialised bacteria to convert organic material — for example, cow poo — into biogas, a versatile fuel.

Once purified, this biomethane, also known as renewable natural gas, is chemically identical to the main ingredient in the fossil-based natural gas that comes out of your stove or heats your water.

Bovine waste is typically stored in vast open lagoons that emit methane —a greenhouse gas more than 80 times as potent as carbon dioxide over 20 years— making agricultural waste the single biggest contributor to total methane emissions from human activity.

Both biogas and fossil natural gas are mostly methane, and though they burn more cleanly than the mega-polluter coal, they still emit carbon dioxide. But by diverting cow poo into biodigesters in the process of making RNG, gas companies argue, the effect is a net climate win.

— Sources: ECCA and Bloomberg

Tank digester on the Landcorp farm at Eyrewell, North Canterbury.

Photo / Natural Systems Ltd

> Farmers are realising that it's sensible to look at biogas energy generation — both to combat the environmental problems with dairy effluent, and because they're concerned with rising energy costs.
>
> Ian Bywater

Agribusiness

Our status quo is not an option

With the prospect of a more stringent emissions reduction target for 2030, the days of the free pass are over

Agribusiness
Brian Fallow

New Zealand will almost certainly pledge a more ambitious medium-term reduction in its greenhouse gas emissions at the global climate change summit in Glasgow in November.

The peer pressure is serious.

The G7 powers at their recent summit in Cornwall committed to cutting their collective emissions by 2030 by around half from 2010 levels, or over half compared with 2005.

New Zealand's current target under the 2015 Paris agreement, which we are not on track to meet, is a 30 per cent reduction from 2005 levels. But the latest national greenhouse gas inventory records that our net emissions in 2019 were 13 per cent above 2010 levels, so heading in the wrong direction.

Not to increase the level of ambition in our nationally determined commitment at Glasgow would be conspicuous for a country which trades on a clean, green brand but ranks fifth highest in the OECD for emissions per capita and third highest per unit of gross domestic product.

We have that dubious distinction because of the outsize contribution of pastoral farming to national emissions. Agriculture accounted for 48 per cent of national emissions in 2019, when the global average is around 13 per cent.

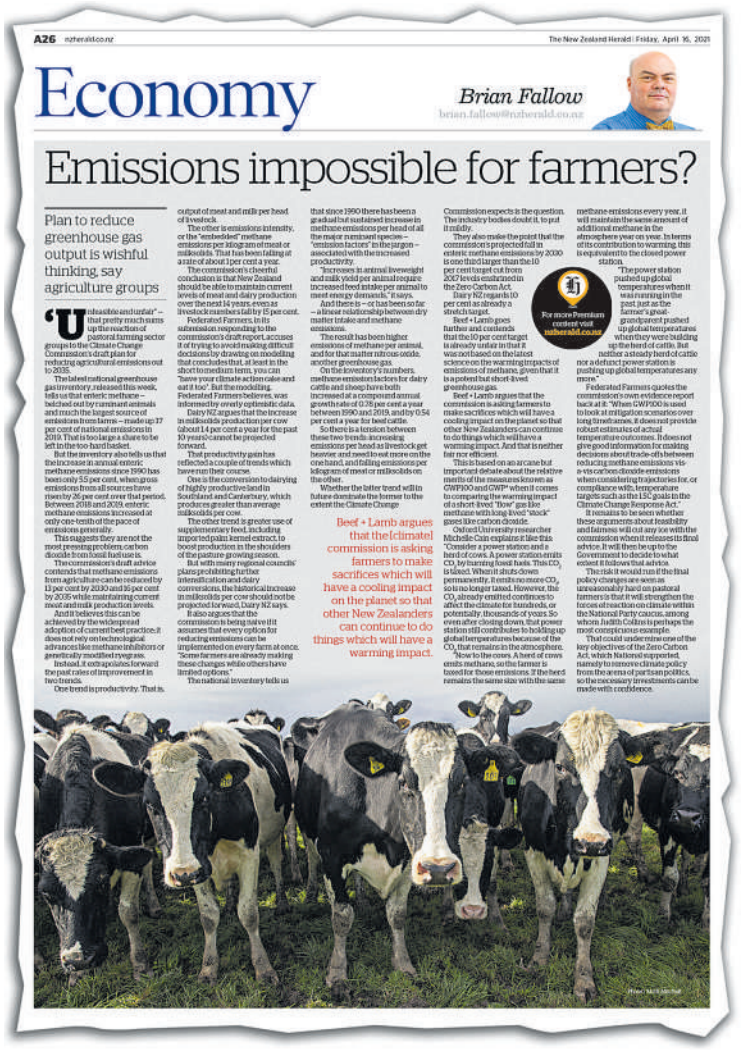
New Zealand is internationally accountable for all of its emissions. If the farmers who are responsible for nearly half the country's emissions, and profit from them escape any cost, and therefore receive no price signal to reduce them, then that is a subsidy from the rest of the economy. The days of that free pass are numbered.

He Waka Eke Noa, a collaborative process between farmer bodies and the Government, is developing a regime for measuring, managing and pricing emissions at the farm level to come into effect in 2025.

The Climate Change Commission is charged with reporting next year on whether sufficient progress is being made to meet that target date. The default, if it is not, would be an emissions price imposed at the processor level, a one-size-fits-all outcome which would be unfair to progressive farmers and also inefficient, as it is behaviour at the farm level that pricing needs to affect.

Whether an emissions price ends up being applied at the farm or processor level, it is accepted that agriculture will be treated like other emissions-intensive trade-exposed (EITE) sectors where "leakage" is an issue.

Leakage is the risk that relatively emissions-efficient producers subject to an emissions price lose market share to more emissions-intensive foreign competitors which do not face a similar price, and the planet is worse off. Under the emission trading scheme that is dealt with by a free allocation of units which limits the proportion of an EITE firm's emissions which are subject to the price.



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Economy

Brian Fallow
brian.fallow@nzherald.co.nz

Emissions impossible for farmers?

Plan to reduce greenhouse gas output is wishful thinking, say agriculture groups

"Unbelievable and unfair" – that pretty much sums up the reaction of pastoral farming sector groups to the Climate Change Commission's draft plan for reducing agricultural emissions out to 2035.

The latest national greenhouse gas inventory, released this week, tells us that enteric methane – belched out by ruminant animals and much the largest source of emissions from farms – made up 17 per cent of national emissions in 2019. That is too large a share to be left to the too-hard basket.

But the inventory also tells us that the increase in annual enteric methane emissions since 1990 has been only 5.5 per cent, when gross emissions from all sources have risen by 26 per cent over that period. Between 2018 and 2019, enteric methane emissions increased at only one-tenth of the pace of emissions generally.

This suggests they are not the most pressing problem, carbon dioxide from fossil fuel use is.

The commission's draft advice contends that methane emissions from agriculture can be reduced by 13 per cent by 2030 and 35 per cent by 2050 while maintaining current meat and milk production levels.

And it believes this can be achieved by the widespread adoption of current best practice; it does not rely on technological advances like methane inhibitors or genetically modified ryegrass.

Instead, it extrapolates forward the past rates of improvement in two trends.

One trend is productivity. That is, output of meat and milk per head of livestock.

The other is emissions intensity, or the "embedded" methane emissions per kilogram of meat or milksolids. That has been falling at a rate of about 1 per cent a year.

The commission's cheerful conclusion is that New Zealand should be able to maintain current levels of meat and dairy production over the next 14 years, even as livestock numbers fall by 15 per cent.

Federated Farmers, in its submission responding to the commission's draft report, accuses it of trying to avoid making difficult decisions by by drawing on modelling that concludes that, at least in the short to medium term, you can "have your climate action cake-and-eat it too". But the modelling, Federated Farmers believes, was informed by overly optimistic data.

Dairy NZ argues that the increase in milksolids production per cow (about 1.4 per cent a year for the past 10 years) cannot be projected forward.

That productivity gain has reflected a couple of trends which have run their course.

One is the conversion to dairying of highly productive land in Southland and Canterbury, which produces greater than average milksolids per cow.

The other trend is greater use of supplementary feed, including imported palm kernel extract, to boost production in the shoulders of the pasture growing season.

But with many regional councils' plans prohibiting further intensification and dairy conversions, the historical increase in milksolids per cow should not be projected forward, Dairy NZ says.

It also argues that the commission is being naive if it assumes that every option for reducing emissions can be implemented on every farm at once. "Some farmers are already making these changes while others have limited options."

The national inventory tells us that since 1990 there has been a gradual but sustained increase in methane emissions per head of all the major ruminant species – "emission factors" in the jargon – associated with the increased productivity.

"Increases in animal liveweight and milk yield per animal require increased feed intake per animal to meet energy demands," it says.

And there is – or has been so far – a linear relationship between dry matter intake and methane emissions.

The result has been higher emissions of methane per animal, and for that matter nitrous oxide, another greenhouse gas.

On the inventory's numbers, methane emission factors for dairy cattle and sheep have both increased at a compound annual growth rate of 0.26 per cent a year between 1990 and 2019, and by 0.54 per cent a year for beef cattle.

So there is a tension between these two trends: increasing emissions per head as livestock get heavier and need to eat more on the one hand, and falling emissions per kilogram of meat or milksolids on the other.

Whether the latter trend will in future dominate the former to the extent the Climate Change Commission expects is the question. The industry bodies doubt it, to put it mildly.

Beef + Lamb argues that the [climate] commission is asking farmers to make sacrifices which will have a cooling impact on the planet so that other New Zealanders can continue to do things which will have a warming impact.

They also make the point that the commission's projected fall in enteric methane emissions by 2030 is one third larger than the 10 per cent target cut from 2017 levels enshrined in the Zero Carbon Act.

Dairy NZ regards 10 per cent as already a stretch target.

Beef + Lamb goes further and contends that the 10 per cent target is already unfair in that it was not based on the latest science on the warming impacts of emissions of methane, given that it is a potent but short-lived greenhouse gas.

Beef + Lamb argues that the commission is asking farmers to make sacrifices which will have a cooling impact on the planet so that other New Zealanders can continue to do things which will have a warming impact. And that is neither fair nor efficient.

This is based on an arcane but important debate about the relative merits of the measures known as GWP100 and GWP* when it comes to comparing the warming impact of a short-lived "flow" gas like methane with long-lived "stock" gases like carbon dioxide.

Oxford University researcher Michelle Cain explains it like this: "Consider a power station and a herd of cows. A power station emits CO_2 by burning fossil fuels. This CO_2 is stored. When it shuts down permanently, it emits no more CO_2 so is no longer taxed. However, the CO_2 already emitted continues to affect the climate for hundreds, or potentially, thousands of years. So when a herd is culled, that power station still contributes to holding up global temperatures because of the CO_2 that remains in the atmosphere.

"Now to the cows. A herd of cows emits methane, so the farmer is taxed for those emissions. If the herd remains the same size with the same methane emissions every year, it will maintain the same amount of additional methane in the atmosphere year on year. In terms of its contribution to warming, this is equivalent to the closed power station.

"The power station pushed up global temperatures when it was running in the past, just as the farmer's great-grandparent pushed up global temperatures when they were building up the herd of cattle. But neither a steady herd of cattle nor a defunct power station is pushing up global temperatures any more."

Federated Farmers quotes the commission's own evidence report back at it: "When GWP100 is used to look at mitigation scenarios over long timeframes, it does not provide robust estimates of actual temperature outcomes. It does not give good information for making decisions about trade-offs between reducing methane emissions vis-a-vis carbon dioxide emissions when considering trajectories for, or compliance with, temperature targets such as the 1.5C goals in the Climate Change Response Act."

It remains to be seen what of these arguments about feasibility and fairness will cut any ice with the commission when it releases its final advice. It will then be up to the Government to decide to what extent it follows that advice.

The risk it would run if the final policy changes are seen as unreasonably hard on pastoral farmers is that it will strengthen the forces of reaction on climate within the National Party caucus, among whom Judith Collins is perhaps the most conspicuous example.

That could undermine one of the key objectives of the Zero Carbon Act, which Bernard expected, namely to remove climate policy from the arena of partisan politics, so the necessary investments can be made with confidence.

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> The default . . . would be an emissions price imposed at the processor level, a one-size-fits-all outcome which would be unfair to progressive farmers and also inefficient, as it is behaviour at the farm level that pricing needs to affect.

But since 1990 – year zero in the greenhouse accounting world – methane emissions have grown by only 5.5 per cent, compared with 45 per cent for nitrous oxide and 46 per cent for carbon dioxide. Nitrous oxide emissions have accounted for 59 per cent of the increase in agriculture sector emissions since 1990.

And whereas methane is a potent but short-lived greenhouse gas, nitrous oxide like carbon dioxide persists in the atmosphere, which is why legislation requires emissions of it to fall to net zero by 2050.

The Climate Change Commission's report to the Government a month ago recommending emissions budgets out to 2035 and recommending broad policies for achieving them, believes it is feasible to reduce both enteric methane and nitrous oxide 11 per cent by 2030. By contrast it calls for net CO2 emissions – net, that is, of sequestration in forests – to be cut 47 per cent by 2030.

Its strategy relies on extrapolating forward a longstanding trend improvement in productivity – output of meat or milk solids per head – but using that to maintain current aggregate levels of production from fewer animals doing less belching and urinating.

It believes that can be achieved by the diffusion of best practice and improving genetics.

"The key requirement for any practice change to reduce total biogenic methane emissions, and not just emissions intensity, is to reduce total dry matter consumption," it says.

"The challenge for farmers is to find a better balance between livestock numbers, production levels and feed inputs (supplementary feed and fertiliser) which enables them to maintain farm profitability while reducing emissions."

The magnitude of that challenge looks a lot greater in the Mataura valley than Wellington's Aro Valley.

What the commission has to say about nitrous oxide is illustrative of its thinking.

"The amount of nitrogen added to the farm system in the form of feed and fertiliser, as part of feed management, will affect how much nitrous oxide is emitted from soil. A system that has fewer animals but maintains the same production requires less feed and thus less nitrogen fertiliser or imported feed inputs, which would reduce nitrous oxide emissions," it says.

Urea fertiliser accounts for about a quarter of nitrous oxide emissions. The commission believes "precision farming" approaches such as sensors and targeted application mechanisms would enable reductions in fertiliser use without compromising pasture growth.

It acknowledges eliminating synthetic nitrogen fertilisers on dairy farms would mean lower levels of production but it says the evidence regarding the economic impact is mixed. While some farms would certainly become less profitable there was also evidence others could maintain or even increase their profitability while eliminating synthetic nitrogen. It could also have co-benefits in terms of run-off and water quality.

In addition, what livestock eat affects how much nitrogen is excreted and thus the nitrous oxide emitted from soils, it says. New Zealand pastures have relatively high nitrogen content, which means that grazing livestock generally consume more nitrogen than they need and the excess ends up in urine and dung.

"Some pasture species, such as plantain, can reduce total nitrogen excretion in urine. Pasture can also be supplemented with lower nitrogen feed, such as fodder beet," the commission says. "Research is also under way to develop a genetically modified type of ryegrass with lower nitrogen than the current pasture."

And some farmers could reduce emissions by reducing the use of palm kernel extract as supplementary feed with lower-nitrogen maize silage.

The Government is required to deliver a national emissions reduction plan by the end of the year. How much of the commission's advice on agriculture survives scrutiny by Ministry of Primary Industries officials and sector groups' lobbying remains to be seen.

But with the prospect of a more stringent national emissions reduction target for 2030 on the one hand, and the pitilessly immutable laws of arithmetic on the other, the status quo is not an option.

Creating the environment for success

New Zealand's farmers and growers have proved their worth over the last year. The world is willing to pay premiums for our high quality primary produce. Our climatic competitive advantage, advanced science and technology, trusted brands and highly productive farmers and growers have delivered this success.

The Primary sector is well placed to meet future trends and market directions. However, the recent KPMG Agri-business Agenda 2021 highlighted that many primary sector leaders are caught up in meeting the Government's transformation agenda when their time could be better spent concentrating on the future of food.

First of all, we need migrant labour. This Government is deliberately restricting labour supply in businesses in an attempt to redistribute income. The Government has an agenda of wealth transfer through increased labour costs. This redistribution approach will lead to reduced investment and jobs in the long term. The horticulture sector experienced this first hand with the lack of regional seasonal employet (RSE) staff. The dairy sector is now squirming at the prospect of up to 4000 vacancies under current immigration settings. Our manufacturing and technology sectors are starting to feel the pinch.

Migrants are necessary to maintain our productive capacity and the competitive drive of our primary sector. Migration should be welcomed and not constrained for political purposes.

Many primary sector leaders are caught up in meeting the Government's transformation agenda , writes **David Bennett**

Secondly, an outcomes based approach should be adopted to environmental regulation. This involves a science-based, practical approach that would be catchment based. It needs to be matched with price signals from exporters. In this way farmers will be customer focused and driven to achieve the environmental standards of our discerning markets.

The current strict inputs based approach to regulation has many flaws, especially if the initial rules are set in the wrong place. We are seeing this in the Freshwater rules. The Government has had to review, trial and amend many of the original proposals.

The strict approach has achieved little and has been divisive in rural communities. There is a rise of anti-regulation sentiment in organisations like the "Groundswell" movement. It has also meant farmers are questioning the "negotiated solutions" that their industry representative groups have taken.

Thirdly, the Governments agenda for personal property rights is creating uncertainty for farmers and growers. They are under attack in the Significant Natural Areas (SNA's), Climate Commission targets or co-governance arrangements. This approach of farming to a consent will stifle land use change, reduce capital investment and lead to a lack of trust in Government. Farmers and growers need the flexibility to meet the changing nature of food production. Our farmers and growers are encountering a true Labour Government that has not been seen for a generation. Labour's control approach reduces their very competitiveness and will limit the very best farmers and growers in the world.

National would in contrast create the environment that sustains a competitive primary sector. National would welcome migration, enable environmental change through an outputs-based approach and protect personal property rights. In this way the best and brightest industries in NZ will continue to excel and deliver on the world stage.

● *David Bennett is National's Agriculture spokesman.*

Agribusiness

A wider role for the banks

Bankers can be a window for farmers into what is happening in the region, across the country and overseas, Westpac's Tim Henshaw tells **Bill Bennett**

Tim Henshaw, Westpac's new head of agribusiness says banks need to play a wider role supporting farmers and growers.

He moved into the job in October after a 17-year career with the bank.

He spent the prior four years as head of corporate business relations.

His agribusiness role is a return to his roots: "I grew up on farms and know the sector first-hand. We've got some fantastic people running great farming businesses. Yet we know farming is an isolating life. Farms are often a long way from town. You or your family might be busy running that farm, but day-to-day you don't see many other people."

Modern farming is a complex business. There is a lot involved in running a farm. Farmers can be time poor; they can't do everything.

Henshaw says this is an opportunity for his team to step in and provide help.

He sees a support role connecting with farmers and growers by being their window into what is happening in the region, across the country and overseas. He says Westpac can help them look forward into the future. "They don't necessarily have the time to sit down and research".

This support now goes well beyond helping farmer to run a business. Today it stretches to helping with wellbeing and the wider social issues affecting the bank's rural customers.

"Westpac is focused on the wellbeing aspects of our rural communities. That's one of the reasons we're very proud to have Sir John Kirwan as an ambassador. He goes into the rural communities and regions to talk to people about wellbeing, how to recognise the signs of mental illness and where to go for help."

Henshaw says another Westpac ambassador, Willie Apiata VC, was with Westpac at this year's Fieldays. "We had him talking about resilience, self-care and checking in on yourself. We think these things are an important part of banks supporting farming communities."

While wellbeing is Westpac's focus, Henshaw says the bank also gets involved in social problem areas such as domestic violence. "There's a drive on this from the top. Former chief executive David McLean, acting CEO Simon Power and the executive team have been behind it. We find it resonates with our people. They can see the organisation they work for is taking on these things and elevating the conversation."

Westpac is one of five large players in New Zealand rural banking. There are the four major banks along with Netherlands-based Rabobank. Kiwibank has a smaller presence.

All the banks are reducing branches throughout the country.

It's an issue that concerns farmers.

Henshaw says a Federated Farmers survey found while only a small number of farmers report they would be impacted by branch closures, the members are concerned about the likely effect on other people in their communities. The banks are testing ways of reducing the impact of closures.

There's a banking hub trial occurring in four places across the country. All the banks have their smart ATMs and other technology in those places. While that trial is happening, the six banks taking part of it have committed to no closures of branches and rural areas for the rest of this year.

"It's a tough one. We know Westpac customers want to interact with us, yet there are 100 internet log-ons for every branch transaction. We still have a team of bankers in the regions who are driving up driveways, sitting down with farmers and having a cup of tea. This will be why farmers feel the branch closures have a less direct effect on them.

Henshaw says the Federated Farmers survey showed Westpac has good support from its customers. "We rated well on satisfaction. I'm lucky to be leading a team of people who have experience with the primary sector. We hear from our customers that Westpac knows farmers and knows what is happening on the farm.

The direction is clear on the sustainability front. All business sectors agree, including agribusiness. It is where we are thinking hard about how we support farmers and growers as they transition towards meeting their requirements.

Tim Henshaw

"Another strength we have in the sector is consistency backing our farmers and grower customers through the inevitable primary sector cycles. Backing customers through the tougher times and those critical moments when there's a once-in-a-lifetime opportunity to purchase a neighbouring farm is important."

Henshaw says a key part of getting this right in the tough times is to help customers prepare when the cycle is on the upswing.

"If, say, the milk price is at a high, the conversation will turn to ensuring that the business is resilient to cope with the next reductions. It could be any one of a range of things such as paying back debt to shore up the balance sheet or investing in improvements such as dealing with effluent or making upgrades. It could be as simple as banking some savings so there is money for when payouts are not so good."

Westpac is focused on the wellbeing aspects of our rural communities. That's one of the reasons we're very proud to have Sir John Kirwan (right) as an ambassador. He goes into the rural communities and regions to talk to people about wellbeing, how to recognise the signs of mental illness and where to go for help.

Sustainability focus

Looking forward Henshaw says he is looking to boost Westpac's sustainability credentials. "The direction is clear on the sustainability front. All business sectors agree, including agribusiness. It is where we are thinking hard about how we support farmers and growers as they transition towards meeting their requirements. This includes matters like the freshwater policy and what is happening with on-farm emissions. This comes back to helping the business build resilience."

Henshaw has created a new role on his leadership team: senior manager — research.

He has moved a banker, who is also a farmer, to take up the position. He is leading the bank's sustainability workstream.

"There is so much coming at our farmers. We need to be able to share ideas and show them what a sustainable farm might look like. They will need help to finance those changes as well. It could be converting a less productive area of the farm to exotic or native forestry or diversifying production. The sooner you start making those plans, the easier it is to make them work. We know some farmers are doing a fantastic job on this, but we want to help spread that knowledge."

Agribusiness

NZTE's 'Made with Care' campaign aims to help lessen barriers created by the five major challenges New Zealand exporters are grappling with.

Why care is a consideration

Tim McCready and **Fran O'Sullivan** on how NZTE is fighting back for exporters

New Zealand has relied on tourism as a way of keeping us alive in the hearts and minds of global consumers.

Research released by New Zealand Trade and Enterprise (NZTE) in April revealed that the five major challenges New Zealand exporters are grappling with are: building brand awareness, finding the right partners and channels, dealing with strong overseas competition, understanding how destination markets differed from New Zealand markets and each other, and determining the right export pricing strategy and product-related costs to remain competitive and profitable.

All these challenges have been heightened during the Covid-19 pandemic, particularly brand awareness and developing the right business connections, given there is no international travel.

NZTE's "Made with Care" campaign aims to help lessen these barriers. Launched in October 2020, the campaign has been designed to grow awareness, preference and demand for New Zealand food and beverage products in key markets offshore, and share New Zealand's commitment to being a trusted, sustainable global food source. It provides New Zealand food and beverage exporters access to a suite of free, ready-made marketing assets to use in their own sales and marketing efforts.

The campaign is part of a wider "Messages from NZ" country brand campaign — a New Zealand Inc effort to raise our international profile in key markets across trade, education and tourism with international consumers, buyers, and investors to help rebuild our economy.

To establish the Made with Care campaign, NZTE joined forces with Tourism New Zealand, Ministry for Primary Industries, Education New Zealand, and New Zealand Story, building on the positive sentiment felt toward New Zealand and raising the international profile of the New Zealand brand across priority markets.

NZTE's lead for food and beverage, Craig Armstrong, says the openness of all organisations to work differently has been the key to the campaign's success.

"We have borrowed a lot of tourism people for the last 15 months to make this work — it's been fantastic," he says. "It really became a partnership to say: 'Well, how can we promote New Zealand products, as opposed to promoting New Zealand as a destination?'".

Armstrong says businesses were telling NZTE the biggest issue for them was not being able to be in market to talk to buyers and consumers.

"What we realised was that we could use this budget to talk to shoppers and buyers at a time when New Zealand businesses could not get there and do it themselves."

When you reflect back on it, we managed to get what can be at times a very competitive industry to work together and agree on something.
Craig Armstrong

The Made with Care campaign includes paid media, social campaigns, and a suite of creative assets including templates, logos, stories, videos, and vignettes that businesses can use as part of their own marketing.

Since its launch, over 340 companies have been involved in the Made with Care campaign — by using the free marketing assets made available, or by participating in promotions managed by NZTE in Australia, China, East Asia, the United Arab Emirates, the UK and North America.

NZTE says because of the campaign, preference and appeal measures for New Zealand food and beverage are trending slightly upwards. As an example, after a short burst of promotional activity in the UK, spontaneous awareness of New Zealand as a country that produces premium quality food and beverage increased 5 per cent, with 57 per cent of research respondents stating they have either bought or are considering buying food and drink from New Zealand because of seeing the campaign.

In North America, awareness of New Zealand food and beverage increased by 10-14.5 per cent across seafood, wine, meat, and honey.

Armstrong says he has been surprised by the results and the cut through the campaign has had with consumers internationally.

"When you reflect back on it, we managed to get what can be at times a very competitive industry to work together and agree on something."

Underpinning the Made with Care sentiment, and what distinguishes New Zealand food and beverage products from others, is the principle of Taiao — the interconnectedness of our people and the natural world.

The values of Kaitiakitanga (guardians, caring for people, place and planet, now and for future generations), Manaakitanga (caring for others and showing hospitality, kindness, generosity, support and respect) and Ingenuity (challenging the status quo with original and bold solutions) are also woven throughout the campaign messaging.

This interconnectedness of people and the natural world, and the desire for sustainable, safe and innovative products are all aspects of the megatrends that are currently shaping the industry, and Armstrong says the desire for these attributes have all been accelerated due to the pandemic.

"What Covid has done is really bring forward consumers' changing preferences by years — whether that is five years, six years, 10 years... I'm not quite sure," he says. "But what we are seeing now is a need or a preference from consumers that is playing into New Zealand's hands. We are a very ethical producer of food, treat our people well, treat our animals well, and generally treat our land well.

"We have got to be able to tell that story and be able to capitalise on what most advanced and developing economies now care about."

He says telling that story is critical, and that most of the growth from exporters is not hampered because we are not in the right markets or don't have the right product, but rather because people don't spend any money on marketing and telling their story.

"Look at the results we are getting through the Made with Care campaign," he says. "Those kinds of numbers should give you an indication that if you invest in marketing and look at it as an investment, rather than a cost, you will get a return out of it."

Insights into key purchase drivers from 14,000 international shoppers

NZTE partnered with global research and insights company Kantar to identify key purchase drivers, supported by insights into behavioural and emotive needs of the primary household shoppers in Australia, China, Singapore, Japan, United States of America and the United Kingdom.

With Kantar, NZTE conducted an online survey with household shoppers in January/February 2021 to examine what's driving purchases within eight different F&B categories and 29 sub-categories, including meat, fruit and vegetables, dairy, seafood, alcoholic beverages, non-alcoholic beverages, sweet snacks and vitamins, minerals and supplements/mānuka honey.

"We learned that eight attributes drive consumer purchases: tasty, affordable, trusted brand, safe product, healthy, fresh, ethical and on-trend," says NZTE's Craig Armstrong.

"Those may sound obvious, but we must understand our consumers rather than base what we do off assumptions. Plus, there is a huge amount of depth and data behind these insights."

Armstrong says the research found five key paths that companies could take to capture a premium: ethical, on-trend, health, safe product and trusted brand. However, he says these vary depending on the market and category, so how businesses construct and communicate their offer needs to be tailored.

"For example, China is influenced by health and safety; Japan by health, taste and freshness; Singapore contains a broader spread of drivers; while Western markets are more driven by affordability, taste and trusted brand.

"However, affordability and taste do not pull in a premium whereas there is real potential for ethical and on-trend purchases to do so, particularly in the US."

Locking in brand sustainability

David Babich, chief executive of Babich Wines says they have seen a 4 per cent lift in website traffic over the time Made with Care has been running.

"While not double-digit growth, it is off good base traffic and in an environment where the investment (hence competitiveness) in this area has been intense due to the global constraint on face-to-face.

"As an exporter you have to make an investment in travel and visiting customers. While people understand the reasons why we can't visit, the time that you can get away with not doing that is fundamentally finite.

"We are going to hit two years without visiting our customers, and meanwhile other competitors are either domiciled in the market or have face-to-face market access because of their own infrastructure — especially the large players.

"We have four people in the US, three in China, one in the UK, so we are not without representation in our key markets, but we don't have an enormous team to continue to push our message relentlessly. A lot of other NZ companies are in that situation.

"Since we can't put a billboard in Times Square, social media has worked particularly well for us to market to the world and get our brand messaging out.

"What has resonated for us in the Made with Care Campaign is that one of our brand platforms is sustainability.

"We lock right into that."

Agribusiness

Two views on New Zealand's trade sector

Mel Poulton

It's my personal view that we have a massive under-utilised resource of women around New Zealand and particularly rural New Zealand who really could contribute in a far more meaningful and effective way to the NZ food and fibre sector, domestically and internationally.

Women are integral to all dimensions of inclusive and sustainable development. A key element to New Zealand's Trade for All agenda.

Trade for All recommendations included the need to be able to enable more women and more women-led businesses into the trade sector.

This is also a big part of the strategy which aims to encourage a trade-led recovery from the pandemic.

To quote the 2015 *McKinsey Global Insights Study*, US$28 trillion will be added to the global GDP in 10 years if women's participation in the paid economy matched that of men's.

That's globally.

And quality education, women's equality and empowerment and also decent work and income growth are three of the seventeen sustainable development goals.

At the KPMG breakfast meeting at Fieldays we heard that when it came to identifying priorities for the Agribusiness Agenda, 'female contributors had given top priority to equipping industry leaders with the skills that they need'.

Which is a divergence from what the rest of the respondents in the survey said.

In the KPMG panel discussion, Lindy Nelson, another great woman leader in our industry, raised a number of great points about how a change in the way of businesses are led will no longer have all the "isms".

The sexism, the racism, and all the other isms, but rather a different approach which women naturally tend to do — around a team approach and collaborative leadership — rather than individual leadership.

Mel Poulton is New Zealand's Special Agricultural Trade Envoy

So, in other words, going forward, businesses are going to be far more team focused and far more inclusive.

So, what are the challenges for women? What are the biases? Both the unconscious and conscious biases, globally and nationally, and some of these challenges could include access to capital and finance, identifying and capturing trade and investment opportunities, policies that disproportionately and negatively affect women, or those with children. Talking about the pay gap, as well as re-entering work. Paid work.

We need more role models, showing young women that they can lead, work and thrive in the food and fibre trade sector.

In New Zealand there are plenty of women leaders and influencers throughout our food and fibre sector.

The Ministry of Foreign Affairs and Trade and NZTE really want to engage with them and help understand how government agencies can be more inclusive of women in the sector.

Todd Muller

Trade Minister Damien O'Connor hopes to get an agreement in principle in a couple of months.

We were tardy but the real test sits in front of him. The Australian-UK deal is a good one and he now has to at least match or better it.

It's fair to say the agriculture market access offer from the UK surprised on the upside. Australian dairy exports will be completely tariff and quota free in five years, beef and sheep meat, 10 years further on, but with reasonable transitional conditions. In return, Australia were comfortable to concede in areas where our Labour Government baulks — an openness to capital, skills and people.

For increased access to UK agricultural markets, Australian Prime Minister Scott Morrison was very happy to welcome less rigorous tests for UK capital, opening up migration settings for UK professionals to live and work in Australia, and expanded visa categories.

Our exporters too, want no constraints in exporting their goods and services to the UK, accepting that there will probably be a similar transition period for our agricultural exports. Our employers want access to significant numbers of UK skilled people to help the recovery of their businesses from Covid-19. Our businesses want UK investment and global perspectives to help fund their growth. Our young people want to travel to the UK and ensure those OE years are a part of their lived experience.

Bi-lateral trade deals are a moment in time for governments to showcase how much they value strengthening integration between two peoples and nations. They are litmus tests on how they see the future. Boris Johnson and Scott Morrison, with their respective "I love Australia" and "Global Britain" mantras express a contagious enthusiasm for what is possible. For them connecting their countries with each other and the world is a critical enabler of global success post-Covid and their respective "go get 'em" attitudes are creating a pervasive domestic momentum.

Todd Muller is National's Trade spokesman.

New Zealand, by contrast, is in perpetual hand-wringing and self-flagellation. We are closed off, seemingly without a plan of opening up; closed to migration of any substance and afraid of foreign investment. At the very time our Trade Minister should be promoting our agricultural sectors sustainability credentials with gusto, this Government holds it up to the light, not to celebrate but to find flaws to critique, regulate and tax.

Bringing this "hunker down", defensive attitude is bad for NZ farmers and wider community, and risks diluting the UK/NZ FTA deal.

The urgency, the enthusiasm and the passion for NZ exporters needs to be front of centre — starting now.

Nothing less will be acceptable to the long term interests of this country.

Agribusiness

Wanted! New FTA partners

A new report urges us to think ahead about new trade partners.

It takes two to tango, but when it comes to trade, the more partners you have the better. New Zealand's trade negotiating dance card has been very full in recent years, but a new report released this week shows that 40 per cent of global consumption is currently beyond our reach.

True some 60 per cent of the trade not currently going to FTA partners is represented by one partner — the United States — which more than justifies continuing the effort to seek a closer economic partnership. India is another partner where we have to think outside the square to grow our economic links. Even with the current busy negotiating agenda, there's still work to do, something Trade Minister Damien O'Connor will doubtless be reflecting on in his stay in MIQ.

New Zealand's trade negotiating agenda is entering a new phase. The "mega-regionals" have now been completed — the little known RCEP (Regional Comprehensive Economic Partnership) and earlier the very well-known CPTPP (Comprehensive and Progressive Agreement on Trans-Pacific Partnership). This means that New Zealand's long-term strategy of seeking transformative agreements with partners in the Asia Pacific region, first outlined in the early 1990s, has largely run its course.

That does not mean of course that the region is trade barrier-free: some of the agreements we have negotiated still do not provide tariff-free market access, especially in dairy and meat, with important partners like Japan, Korea and Canada. We have to work to upgrade and expand existing agreements, as we have recently done with China, and we have important negotiations with the EU, the UK and others to complete.

● *Stephen Jacobi is Executive Director of the NZ International Business Forum.*

New Zealand's trade negotiating dance card has been very full in recent years, but a new report released this week shows that 40 per cent of global consumption is currently beyond our reach.

But this new report is deliberately not about the existing agenda: it is about the future and about the other partners to which New Zealand should be looking. Much of this work is by nature long term. The pathway to launching trade negotiations can take many years. It has become fashionable lately to remind exporters of the need for diversification. Guess what — they get it already. Unless someone is suggesting we sell less to China, and leave much needed foreign exchange on the table, the real aim is to ensure that New Zealand businesses have options. If there is anything that the last few years of global trade turbulence have shown, it is that exporters need to be able to pivot, sometimes at very short notice, and that is very difficult to do in the face of tariff and non-tariff barriers.

The report rightly concludes that "she's a hard road finding the perfect FTA partner". It uses a data-driven approach to establish a number of key economic factors and an "FTA Suitability Index" to point to a list of 22 economies (below) which we should at least be seriously considering. The list itself is not so important as starting the process of thinking about how best to engage with future partners, whether on the basis of high quality and comprehensive FTAs or other means.

The keen observer will notice there are immediate negotiating difficulties likely to arise with most of these potential partners. The two highest-polling candidates, Switzerland and Norway, are not likely to want to welcome agricultural trade liberalisation. But they are also members of the European Free Trade Area (EFTA) and closely aligned with the EU, with whom we are already negotiating. Norway is a participant in the NZ-led ACCTS (Agreement on Climate Change, Trade and Sustainability), suggesting some common interests on which to build. Others on the list are not well known to New Zealand — take for example Morocco, the Dominican Republic or Côte d'Ivoire.

Nor is it possible for a quantitative survey such as this to consider all the relevant factors or to reflect the commercial strategies of all participants in the export sector. Companies may have multiple aims for developing certain markets and historical trade statistics may not reflect trade that might occur if barriers were lowered.

The report also makes clear the prize of seeking to expand even further New Zealand's existing FTA coverage. Many of these economies have large populations and can be important markets for exports — moreover, these markets also have significant GDP and middle class growth. With an eye to the future, such growth opportunities are critical.

This report focuses largely on goods trade but in recent years, before the pandemic, services including tourism and education crept up to around 30 per cent of our exports: post-pandemic, services and digital trade will be key to a resilient trade future, also serving as enablers of physical goods exports (e.g. via paperless trade and backbone services for global value chains such as logistics and technical testing). Future FTAs can also include new issues such as the environment, including climate change, while extending the opportunities to benefit from trade to small and medium-sized enterprises, women and the Māori economy.

FTAs are not the only factor in developing export business. At best they open doors which businesses can then go through and they provide an environment within which costs are lowered, time can be saved and risks are mitigated. The process also help bring potential markets onto the radar of business on both sides. Those things still matter, especially for smaller businesses and small economies such as ours. As the pandemic has shown, trade has continued to uphold the New Zealand economy through the crisis. Other storms are likely to appear in the future and while we are rightly doing the business of today, it is useful to build for tomorrow.

This report will hopefully spark discussion between businesses, stakeholders and the Government. Inevitably there will be decisions to be made about priorities and resources. But as we plot a course of recovery from the pandemic, we need to be thinking ahead. Trade, like complex dance routines, takes time to learn.

All the more reason to start now.

● *"Wanted! Free Trade Partners" is a report commissioned by the NZ International Business Forum and prepared by Sense Partners. The full report is available here www.tradeworks.org.nz*

Agribusiness

People, planet — and profit

With its emphasis on sustainable farming and protecting natural resources, Māori agribusiness will continue to make a significant impact on the New Zealand economy, writes **Graham Skellern**

Mavis Mullins, businesswoman and chairman of the Atihau Whanganui Incorporation, says Māori agribusiness has now been acknowledged in its own right because of its different approach and personality to business, to life and to balance.

Māori agribusiness is unique in that it is driven not only by financial outcomes but by principles of kaitiakitanga (responsibility), manaakitanga (supporting people) and taonga tuku iho mō ngā uri whakatipu (guardianship of resources for future generations).

"The change has been the recognition that Māori concepts and practices have a strong alignment with consumer values and environmental stewardship," says Mullins. "The balance between profit, people and planet is an imperative — and as a component of the national economy, Māori agribusiness continues to trend positively."

There has been a mergence of concepts such as Te Taiao (environment of soil, land, freshwater and living communities) and He Waka eke Noa (working in unity) that provide a balance between western and Māori science (matauranga).

"These concepts are being applied with greater attention to knowing our current state; how we do more with less chemicals, less animals and less interventions; and communities coming together to test and solve challenges such as the Tararua Plaintain project and Te Kauru Hapu initiatives on improving the health of the Manawatū River.

Plantain, a leafy herb with a coarse, fibrous root system and tolerance to summer heat, is being trialled as a feed for cows. Plantain is shown to reduce the nitrogen concentration in cows' urine, reducing nitrate leaching and greenhouse gas emissions, and improving waterways.

Mullins says the (Māori agribusiness) strategies are well-aligned to long-term, inter-generational thinking, planning and connection — farming to enhance the environment, farming to connect with the right consumers and their needs, farming to show hospitality, gratitude and care in the production of food and fibre products, and farming to bring health and wealth to Māori people.

"From my perspective, the view of Te Ao Māori is to produce and present safe, enticing, delicious food is a way of showing manaakitanga or hospitality, love and care to the consumer of that food. It is potentially these concepts that mark the exciting growth opportunities.

"Export is very important, but we have been reminded through Covid-19 that to provide for our own first should surely be our goal."

The latest *Te Ohanga Māori* report, prepared by Business and Economic Research (BERL) in conjunction with the Reserve Bank, estimated that the Māori economy was worth $68.7 billion in 2018, up from $42.6b in 2013. New Zealand's present gross domestic product is more than $320b.

> The balance between profit, people and planet is an imperative — and as a component of the national economy, Māori agribusiness continues to trend positively.
> Mavis Mullins

BERL says the 60 per cent growth between 2013 and 2018 means the size of the Māori economy is likely to reach New Zealand Trade and Enterprise's estimate of $100b before 2030.

In 2018, nearly $21b resided within Māori trusts, incorporations and entities, with $14b in the natural resource-based sectors. The report said sheep and beef farming continues to dominate Māori assets in the agriculture sector, although assets in horticulture including kiwifruit are growing in significance.

Amongst the collectives, sheep and beef contributed $7.1b, dairy $2.75b, forestry $990 million, fishing and aquaculture $2.37b and kiwifruit $440m. The Māori workforce in agriculture, forestry and fishing grew to 22,500, with dairying taking more than 4000, sheep and beef 3200, forestry 2250, horticulture 3800. Meat and dairy processing also attracted more than 11,000 workers.

The report said "the Māori economy is key to the wellbeing of Māori, and is a significant and increasingly important contributor to the wider economy. Te Ōhanga Māori is no longer a separate, distinct, and clearly identifiable segment.

"It is a closely connected component of numerous pieces of the jigsaw puzzle that together make up the economy of Aotearoa."

BERL chief economist Hillmare Schulze said Māori were still key players in the more traditional primary sectors but the asset base was increasingly diversified. Any description of the Māori economy needed to go beyond Te Tiriti settlements — many businesses and trusts existed before the beginning of the settlement processes, producing goods and delivering services.

Chapman Tripp, in its *Te Ao Māori Trends and Insights* report, says further treaty settlements and increased merger and acquisition activity will drive the continued growth in the Māori economy. There will be increased participation in export markets, increased collaboration amongst Māori-owned entities, and increased social investment and disbursement among iwi members.

Chapman Tripp says assets are still largely concentrated in primary industries, though there is increased diversification into areas such as geothermal, digital, services, education, tourism and housing.

Māori own 40 per cent of New Zealand's forestry assets, 30 per cent of lamb production, 10 per cent of dairy production, 50 per cent of the fishing quota, 30 per cent of sheep and beef production, and 10 per cent of kiwifruit.

The treaty settlements have allowed iwi organisations such as Ngāi Tahu, Tainui, Tuhoe and Ngāti Porou to accelerate their interests in agribusiness.

Ngāi Tahu, for instance, has six dairy farms covering 2000 hectares at Eyrewell, north west of Christchurch, each farm having a 64-bail rotary milking shed and a herd of 1400 cows — with plans to increase the farmland to 6700ha and incorporating 150ha of native bush.

In addition, Ngāi Tahu has three High Country Stations near Lake Wakatipu totalling 36,000ha for sheep, deer and cattle breeding. Ngāi Tahu wants to become a 60,000ha farming operating, calling on the best expert advice and using the latest farm technology to minimise the environmental impact and maximise production.

Waikato Tainui owns more than 4000ha of farmland supporting dairy, sheep, beef and forestry operations.

With Tainui Group Holdings and Pioneer Capital, Ngāi Tahu has taken a 33 per cent stake in Waikato Milking Systems, one of the largest producers of rotary milking systems in the world and providing dairy farm solutions in more than 30 countries, including the United States, Russia and China.

Ngāi Tahu manages all its fisheries assets and exports lobster, oysters and mussels under the Tahu brand. It also leases annual catch entitlements of wet fish to partners with agreed catch plans for Ngāi Tahu fishers.

A group of trusts and incorporations, led by Wairarapa Moana Incorporation chairman Kingi Smiler and Tuaropaki Trust chairman Tumanako Wereta, developed the first Māori-owned milk processing plant, Miraka Dairy Factory, near Taupō.

Miraka, which has formed a partnership with investor Vietnam Dairy Products, has the capacity to process more than 250,000 litres of milk into powders and ultra-high temperature (UHT) products every year.

Taupō Pure Milk and Miraka Whole powders, and UHT products are exported to the Americas, the Caribbean, Africa, Middle East, Asia, Australia and the Pacific.

The factory, powered by renewable geothermal energy, is supplied by 55,000 cows on 98 farms, and has an innovative waste treatment system where the fat and liquid from the wastewater is separated — with the fat going to a warm farm and liquid irrigated on to farmland.

The state-of-the-art UHT facility has a capacity for 60m litres a year, and Miraka has signed a tripartite agreement with Shanghai Pengxin and Mengniu to supply China.

Miraka has also invested in a $90 million GEA spray drier which was built onsite and produces eight tonnes of whole milk powder per hour.

Ngāti Porou has joined other iwi including Parininihi ki Waitotara, Iwi Collective Partnership and Ngāti Mutunga ki Wharekauri (Chatham Islands) in owning Port Nicholson Fisheries, in collaboration with Moana New Zealand.

Port Nicholson exports premium live lobster to China, and has the capacity to process 650 tonnes of lobster quota — almost half of the North Island and the Chatham Islands total allowable commercial catch and 23 per cent of New Zealand's total live lobster exports

The proposed Māori investment fund, spearheaded by the New Zealand Superannuation Fund, is looking to pool iwi assets and create a united investment vehicle.

Chapman Tripp says "if it materialises, the Māori investment fund could be a private equity co-investor with NZ Super and give the investment entities of Māori collectives access to previously out-of-scope deals, both in the domestic market and internationally.

'Unique': Insights from Māori frontier firms

Māori firms have unique features that support innovation is the verdict from the Productivity Commission's frontier firms inquiry.

The commission's report said the Māori economy exhibits many of the characteristics needed for firms to innovate, grow and support improved wellbeing.

Figures from Stats NZ show that employment in Māori authorities and SMEs has been growing faster than in the wider economy.

Māori authorities and SMEs are more likely to export, and have higher rates of innovation and R&D, than other New Zealand firms.

Research for the inquiry found that Māori frontier firms are able to leverage features of their business to create opportunities for innovation and growth.

For example, the need of Māori firms to serve multiple bottom lines (such as commercial, environmental, social and cultural objectives) can be a strong driver of ambition, which can also flow through to expectations placed on suppliers.

Further, high shareholder ambition, together with a long-term view, can spur innovation and experimentation, provided the underlying assets are not put at risk.

Māori values help differentiate Māori goods and services and provide added brand value overseas.

The values also closely align with the growth in consumer demand for products with strong environmental and social credentials. This presents growth opportunities for kaupapa Māori firms.

Common values and features also help bring Māori firms together around shared goals.

Formal and informal networks among Māori firms are important mechanisms for diffusing knowledge, exploring innovations and enabling collaboration.

Success breeds success

The successes of Māori frontier firms build their confidence and ambition, and can help light the way for other Māori firms.

For example, the Tawapata South Incorporation is a Māori entity that runs Onenui Station, a 10,000 acre farming block on the Māhia Peninsula.

Tawapata South formed a partnership with Rocket Lab, setting aside land for Rocket Lab to use as its launch site.

A multiple bottom lines approach played an instrumental role in developing this partnership. The success of the partnership has built the confidence of Tawapata South's committee and owners.

It has led to further opportunities for the farm's business, including conservation initiatives, infrastructure developments and R&D with a neighbouring farm to identify agricultural innovations.

Learning from Māori firms

Māori firms also offer valuable lessons for other New Zealand firms. Taking a long-term view and managing multiple bottom lines do not need to be traded off against innovation and productivity.

Rather, they can be complementary.

Long investment horizons are important for supporting experimentation and innovation, and long-term value creation.

This contrasts with a short-term focus on financial performance and shareholder returns that can dominate the focus of company boards and management.

www.productivity.govt.nz/inquiries/frontier-firms

Agribusiness

From the ground in China

China is a major market for New Zealand's exports and for our biggest agri exporters it is one of their most important strategic markets. Fonterra's Greater China CEO **Teh-Han Chow** and Zespri's chief executive officer **Dan Mathieson** share with **Fran O'Sullivan** some of their on-the-ground insights from China where the CEOs' ability to travel frequently over the past year has been curtailed by Covid.

Teh-han Chow (above) at an importer expo in China last November. Dan Mathieson says Zespri learned a lot from China through Covid.

Herald: How has the last year been for each of you leading operations in China during the Covid-19 pandemic:

Dan Mathieson: When I started with Zespri back in the end of 2002, only about 2 per cent of our total sales went to China. It is now over 20 per cent by volume. China has been a very important part of our growth, alongside the development that has been going on in other markets across Europe, Japan and in some exciting new markets like Vietnam and the USA.

We have seen increasing demand for kiwifruit, and in part that has been bolstered by the focus on health from consumers through the pandemic which has been very favourable for Zespri.

One of the partnerships that has been very successful for us in China has been our fruit retailing platform Pagoda — one of the largest fruit shop chains with over 5000 stores. That close partnership allowed us to bring our SunGold and Zespri Green kiwifruit quickly into market. Pagoda told us that SunGold was the only fruit category to grow both in terms of volume and value during the pandemic.

We estimate that last year around 25 per cent of our Zespri fruit was sold online — up from 18 per cent the year prior. It's an area that we are going to continue to focus on and build in the post-pandemic era. It is not unimaginable to think that even in the next few years more than 50 per cent of our kiwifruit will be sold through online channels.

Over the last 20 years, we have made sure we have very strong relationships and trust at the critical points of our supply chain, so that we can have discussions and clarify issues quickly and build goodwill. Engagement in general is important around the world but it is very critical in China — building relationships and wide networks, engaging constructively and investing in being present.

Teh-han Chow: China is a very important market for Fonterra. About a third of our New Zealand farmers' milk is sold into cities in China, either as ingredients, food service applications or consumer products. China is also where a lot of Fonterra's innovation expertise comes to life.

Like all markets around the world, we have been impacted by Covid-19. Our last 12 months have looked a lot different than what we originally intended.

When Covid came and strict government restrictions were introduced our food service was hit the hardest — all the restaurants were closed. But we saw a very quick recovery — it was very V shaped, and by April things were very close to normal. There was also very little impact on our ingredients business throughout, which helped us to manage through the impact. For consumers, we saw a big swing from offline to online.

But what we also learned during this time in Covid is that a lot of trends have been accelerated, which in turn has seen our plans accelerate.

Over the past 12 months we have seen our ability to flex, bringing different product categories depending on demand into the market and responding quickly to our changing customer needs. This has kept our business not only stable but thriving.

We have been very market-led and customer centric, which is part of the core to our strategy. This approach allows us to stay closer to our customers and meant that even in Covid we were in constant communication with our customers, trying to understand their needs and expectations — especially as they evolve.

Herald: What has it been like navigating through Covid-19 within China with the twin pressure of keeping your markets operating and your staff safe?

Dan Mathieson: China was the first country in the world to go through Covid, so it was a little bit of learning as we went there. We gave our leadership in China full autonomy and responsibility to look after their people first, as you can imagine that is the number one priority we set and everything else was second.

We quickly moved people to work from home. We closed the office, and then we were able to feed back in real time how people were being supported in China. As the pandemic evolved around the world, we were able to take those learnings and support our people in other countries in the best way possible. We learnt a lot from China, and that has helped our other markets to operate the best they way can in the pandemic environment.

> We learnt a lot from China, and that has helped our other markets to operate the best they way can in the pandemic environment.
>
> Dan Mathieson

> Even in Covid we were in constant communication with our customers, trying to understand their needs and expectations .
>
> Teh-han Chow

Teh-han Chow: Very similar for us, too, in terms of putting people first. At that point in time we had about 1700 people on the ground in China. As it happened, I was out of China when the outbreak occurred, so I rushed back in early February to be with them — leaving my family behind. It was important to be with our teams and immediately become very agile, changing the way we work. The response from our team was fabulous — people were up to the challenge. We made sure everyone was safe, provided personal protection equipment and enhanced processes across our farms where we had to continue operating 24/7.

Herald: The Covid-19 pandemic has resulted in an impact on the regulatory environment in China. How are both of you navigating that?

Teh-han Chow: We are constantly seeing the regulatory environment evolve — especially across the infant formula space. Given the crisis that China went through over a decade ago (melamine disaster) there is still a concern to make sure that food safety is top of mind. We continue to see regulatory policies that are strengthening consumers' right to get high quality and safe food.

Dan Mathieson: Obviously looking after Chinese consumers is paramount for the Chinese Government. They are taking a very cautious approach to food being imported into China. They are asking for extra checks, extra transparency around data, and looking at the track record of your performance and history bringing food across the border. Those companies that have done it well for a long time have been shown a lot of good will by the Chinese authorities.

We're in close communication with customs as to any changes coming up, and they've been well-flagged to us so that we can make the necessary changes back in New Zealand should we need to.

Herald: How would you describe the contribution of the Fonterra and Zespri brands in China?

Teh-han Chow: We are a global nutrition company, and we are interested in making sure that we're able to contribute to the nutrition of consumers in China. It is not just your basic dairy nutrition, it's about advanced nutrition — products for infants, functional nutrition — I think these are all areas we have a good opportunity to contribute to the development of consumer benefit in China.

Dan Mathieson: I think wellbeing would be the one word. There is the goodness our kiwifruit can provide to consumers, but it is broader than that. It is about continuing to grow China in a very positive and healthy way, so that all the partners across our ecosystem are continuing to do well, as we continue to do well in China. And that's obviously very similar to what Teh-Han just talked about the goodness that our kiwifruit can provide through to consumers, but it's actually broader than that, it's about continuing to grow in China in a very positive and healthy way, so that all of the partners across our ecosystem are continuing to do well, as we continue to do well in China. That is fundamental to our success — if we are unable to demonstrate that, then I think our continued growth in China will be short-lived.

Herald: How does your deep e-commerce experience in China give you a head start in other geographies where e-commerce growth has also accelerated due to Covid?

Dan Mathieson: We are seeing that around the world now take off. It used to be that China was well ahead of all the other markets; Korea was a distant second and then the rest of the world was still very much in its infancy — particularly when it came to perishable products being sold through e-commerce, and fruit a part of that.

What we have seen through the pandemic in the last 12 months is an acceleration unanimously across the board of all markets. We have been able to share those learnings around how we market online and how we sell and promote online to our other markets. That has helped us develop our online sales channels and marketing approach very quickly. As a result, we are seeing an acceleration of e-commerce sales across the full spectrum of markets, and we expect that to continue.

From an interview with Fran O'Sullivan at the China Business Summit.

Agribusiness

Building a long-term relationship

Kono NZ chair Paul Morgan says the company's success in China is down to its committed strategy to add value to NZ food and beverages and its effort to build a long-term relationship.

The company is a vertically integrated, family-owned Māori food and beverage producer. It produces and exports award-winning wine, cider, craft beer, seafood, fruit and natural fruit bars. Aspiring to be the world's best indigenous food and beverage provider, Kono has a global consumer focus, particularly in Asia where it has successfully established a wholly-owned trading entity in Shanghai.

Says Morgan: "Kono is a food and beverage producer. Our most well-known brand in New Zealand is Tohu Wines. But we are also a land owner, a water owner — we started many years ago on a journey to integrate our business with a focus on securing customer and consumer relationships around the world.

"The other aspect to our business is that we are focused on how we can create intellectual property, knowledge, and secure that for commercial benefit. Those are two things in our minds when we discuss our future direction."

Kono — which is an associated business of Wakatū Incorporation — farms 530 hectares of land and sea whilst based in the Nelson, Tasman and Marlborough region.

Kono started its journey 25 years ago in the 'live, fresh, and very expensive' lobster business. "It is still that today, Chinese people love lobster," says Morgan.

"They love banquets, they love family occasions and entertaining — and it's good for the lobster industry in New Zealand."

Paul Morgan speaks to the China Business Summit.

Kono is a diversified businesses that started in China.

As part of that journey, it joined with the seafood industry, and invested in a WFOE (wholly foreign-owned enterprise) a decade ago.

"We now own the company, we have our own food licensing in China, and we have our own people there. That has provided us with more resilience and more certainty in our relationship with our customers in China, which is important because we are quite certain that we will have a long-term relationship with China."

"For Māori, we are comfortable with that.

"We came many millennia ago from Asia, into Polynesia and the Pacific, and ended up here in Aotearoa. We have the ability to engage relationship-wise effectively and quickly with our Chinese kin."

Morgan says with Kono's investment and strategy in China, it has to add a lot more value to its exports to China. Kono is investing in food science, science technology, including human clinical trials for food solutions to consumers, that requires committed strategy and capital to invest.

"We are migrating New Zealand's food offering into high-value ingredients, nutraceutical products, functional drinks — all of these are things that we can secure greater value."

Says Morgan, in China, Kono's general strategy is to have customer-consumer relationships, and to find partners that it can do this business with. "That takes time and it takes money, you have got to be committed to it."

"We are happy we are moving forward, but most importantly for us we haven't lost sight of the long-term strategy of how we are going to invest as a company and build our future in China as a very important part of that opportunity going forward.

> We came many millennia ago from Asia, into Polynesia and the Pacific, and ended up here in Aotearoa. We have the ability to engage relationship-wise effectively and quickly with our Chinese kin.

"We do need to see partnerships — whether it is at business level or government level in research, science development and tech transfer. China will quickly be number one in climate change management; they are quickly moving but we don't realise. They have got the technology coming through, and we need that sort of relationship to improve our business performance."

— *Fran O'Sullivan*

Agribusiness

‘We need something we can

New research by Plant & Food could provide the means to supply nutrition and sustenance to the world

Open ocean aquaculture

Plant & Food Research, a Crown Research Institute, is working on ways to increase fish production through open ocean aquaculture.

Global demand for seafood continues to grow, but if production remains static, supply will fall massively short of demand. Managed sustainably, mobile oceanic fish farms off New Zealand’s coastline may soon provide a means to supply nutrition and sustenance to the world.

Suzy Black, Open Ocean Aquaculture Direction leader at Plant & Food Research, says the research programme is taking a unique approach by looking at the idea from the point of view of fish. “We are asking ‘what do they need to be at their best?’ This means understanding fish needs and behaviour and incorporating that into the design.

Plant & Food Research’s open ocean aquaculture work has the potential to create a whole new sector with new technologies, new industries and regional jobs.

> We are taking a mobile approach and trying to work with the environment, rather than against it.
>
> Suzy Black, Open Ocean Aquaculture Direction leader, Plant & Food Research

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A breakthrough 400 million years in the making

Mark Peart

Having spent 20 years researching how smell receptors in insects work, it’s no wonder former Plant and Food scientist Dr Andrew Kralicek is excited at the prospect of a groundbreaking discovery becoming commercialised.

Kralicek discovered how a panel of synthetic insect receptors could be used to create a device to smell and taste chemical compounds. Scentian Bio, of which he is chief technology officer, was formed to create a novel technology for commercial use in medical, food or industrial settings.

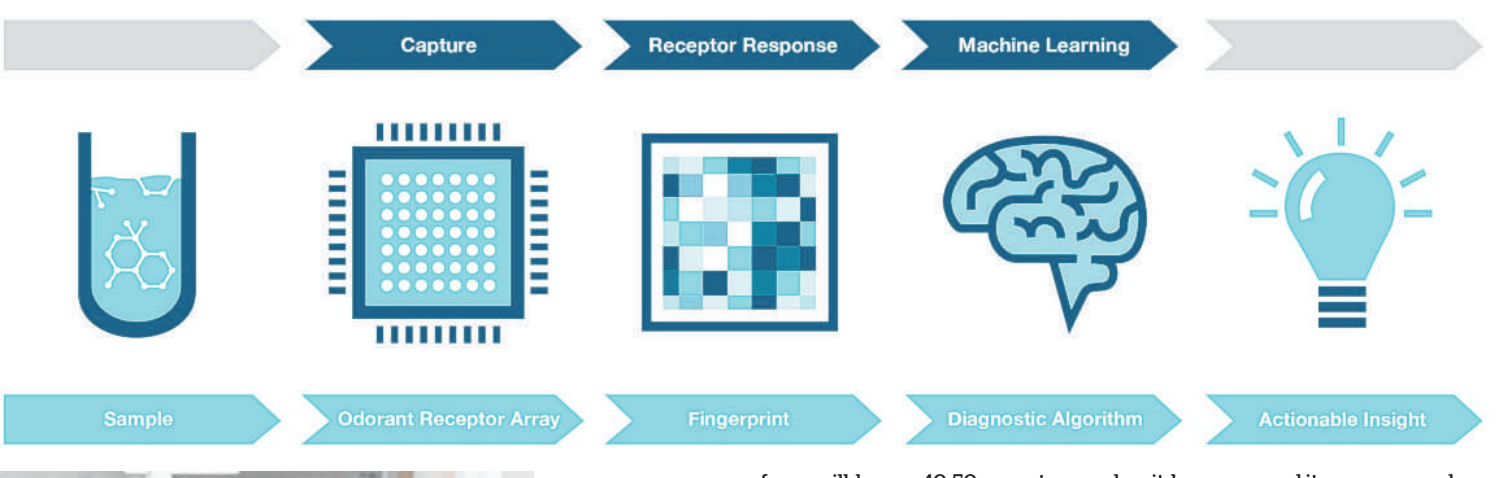
These receptors are the result of 400 million years of evolution and enable insects to easily find mates, detect predators, find food, or where to lay eggs with their receptors. Kralicek’s team investigated whether insect smell receptors could be combined with electronics to create an “insect nose/tongue”.

Kralicek went through North Island company Sprout Agritech’s Accelerator to understand how to commercialise his discovery,

Sprout and Plant & Food Research partnered to spin-out the Scentian Bio technology with a $1 million investment from Sprout and its partners — Finistere Ventures, Fonterra, OurCrowd, and Callaghan Innovation.

Cardea Bio, a San Diego-based biotech that integrates molecular biology with semiconductor electronics, recently partnered with Scentian Bio to support its manufacture of the bioelectronic tongue/nose tech platform.

Kralicek says that across the food supply chain, flavour and fragrance quality control currently relies on legacy methods, including so-called “taste testers” or slow, bulky, expensive lab instruments, which take hours or days to produce results. Cardea and Scentian’s bio-electronic platform will speed up testing, is small enough to fit in a handheld device, and simple enough to use anywhere by anyone.



Andrew Kralicek has developed a novel technology based on insect receptors.

Kralicek says more than 30 years of combined scientific diligence is going into the platform. “The combination of Cardea’s technology with our insect odourant receptors enables us to translate the language of chemical compounds into digital signals to analyse food components, detect airborne and liquid-based toxins, and diagnose disease in almost real-time on a massive scale.”

Every flavour and fragrance has a unique combination of volatile organic compounds (VOCs) that can be read by the system. Scentian’s platform will house 40-50 receptors and will be able to detect thousands of chemical signals at the push of a button.

With the support of Cardea, Scentian plans to expand its offerings to broader food quality testing, as well as animal and human disease diagnostics. This collaboration aims to resolve the challenges associated with standard detection methods, which are typically slow and expensive, as they can only be run with the help of complex scientific personnel, laboratories, and techniques.

Development of next-generation diagnostic tools that could bypass complex chemical assays and detect the presence of diseases based on their distinctive VOC profiles from, for example, a patient’s breath, are also planned.

“These chemicals are all information about the state of these biological systems. This is a chemical language waiting to be interpreted — it’s just sitting there, and no-one’s reading it. Animals can read it, dogs can read it, bees can read it — we can read some of it, but only with our noses,” Kralicek said.

In August Scentia will embark on a six-month proof of concept study.

“We’re going to take the library of receptors, put them on chips, and show that they are all accurate — and that they actually do something. Then we are going to develop three different flavours and put them on the chip and to show the world that we can produce unique tasteprints.”

“In six months, we’ll know whether this technology is going to work.”

Cardea chief executive Michael Heltzen said it was “fascinating” to see Scentian make synthetic insect odour receptors and integrate them with his company’s technology, so together, they can link smells and tastes up to the digital world.

Heltzen said the idea of electronic noses that are based on biological receptors had been dreamt about and theorised for generations — they were now running in labs because of the innovation partnership.

Agribusiness

market as uniquely Kiwi'

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Black says the team is taking the knowledge it already has about near-shore aquaculture and making it more sustainable for the ocean.

"Our approach is a bit different from what you see overseas where ocean aquaculture systems are mostly enormous structures built to withstand harsh ocean conditions.

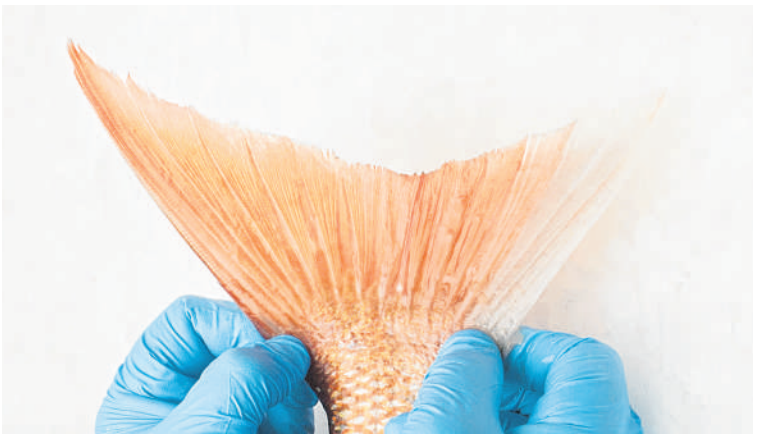
"We are taking a mobile approach and trying to work with the environment, rather than against it," says Black.

The mobile prototype is still in development, and it is too early to know what it might look like. But Black says the aim is to move the systems around the ocean autonomously so fish can experience the temperatures, currents and water quality to ensure they are in the best environment year-round.

"If this takes off, there is so much opportunity for Aotearoa," she says. "This has the potential to create a whole new sector with new technologies, new industries and regional jobs".

The open ocean aquaculture work is being done by scientists at Plant & Food Research in collaboration with science organisations overseas and in New Zealand, including Cawthron Institute and the Universities of Auckland and Otago. The programme is funded by the Ministry of Business, Innovation and Employment and Plant & Food Research's internal Growing Futures investment.

Plant proteins could be used to create new vegan-friendly meat alternatives; high-value molecules could be extracted from seafood during processing.



Extracting protein from pasture

Generations of New Zealand farmers have excelled at growing pasture for livestock. The leaves of these crops are rare examples of plant proteins with a full complement of essential amino acids – the building blocks of proteins that humans need to keep their bodies functioning.

In response to the increasing population of people looking for plant-based protein, Plant & Food Research is looking into different ways to harness the goodness of plants.

"It's important for Aotearoa New Zealand's economic future that the food industry develops new plant-based food options for consumers, creating a wider portfolio of products and reducing our reliance on animals for both our own diets and for export," says Dr Jocelyn Eason, GM Science Food Innovation at Plant & Food Research.

"The challenge in being so far from our major markets is that our export products need to be of high value, compared to alternatives. We can't produce commodity plant protein ingredients, like pea or soy protein ingredients, for export as our competitors operate at scales we cannot achieve.

"We need something extra, something we can market as uniquely Kiwi, such as ingredients from plants that offer more or capitalise on our reputation for innovative sustainably-grown foods."

Eason says by incorporating these crops into rotational farming practices, we could create a food protein ingredient with the unique characteristics needed for the New Zealand food industry and with positive sustainability credentials.

Proteins from plants could be used as foundation ingredients in a range of different manufactured foods, such as protein-fortified beverages, nutrition bars or healthy foods for seniors. They could also be used to create new vegan-friendly meat alternatives, providing the full range of essential amino acids in one product.

A side-benefit of extracting protein from plants traditionally used in animal feed is reducing the amount of protein in the diet of stock. The by-products of the isolation process still have nutritional benefits for animals but, by removing some of the protein – the compounds responsible for the nitrogen expelled in urine – the amount of nitrogen leaching into soils and waterways is reduced, improving the impact of animal farming on the environment and enhancing New Zealand's clean green reputation.

High value marine molecules

Cyber Physical Seafood Systems (Cyber-Marine) is a research programme led by Plant & Food Research that is looking at extracting high-value molecules from seafood during processing. The idea is to create automated multi-operation flexible factories, monitored by artificial intelligence (AI) sensor systems. These factories will analyse seafood as it enters the factory and determine the best way to process it to achieve 100 per cent utilisation and maximise the value for all harvested wild and aquaculture seafood.

By making use of all raw material, this will allow the industry to achieve growth targets without increasing catch volume from wild-capture fisheries, as well as maximise value from increasing aquaculture. It is envisioned that once established for the seafood industry, the technology could be adapted for any bio-industrial process.

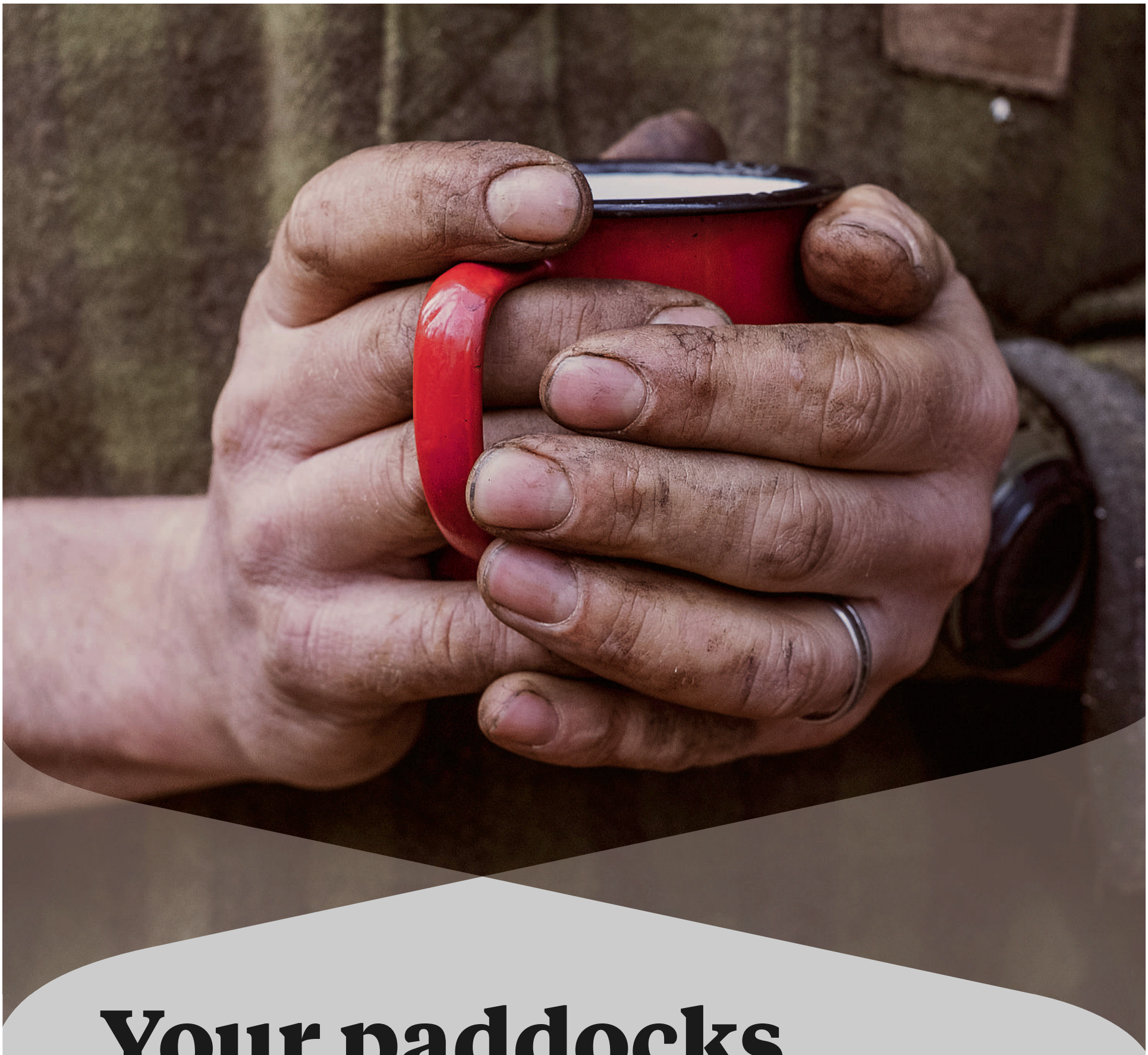
> The challenge in being so far from our major markets is that our export products need to be of high value, compared to alternatives.
>
> Jocelyn Eason, GM Science Food Innovation, Plant & Food Research

In addition to its role as a food source, seafood contains a range of marine molecules with special properties. They range from big structural proteins for biomedical scaffolds, through to anti-inflammatory omega-3s, and blood pressure-lowering or anti-aging peptides.

"Many of these molecules can be found in marine by-products and by-catch, so by extracting them for new products our seafood industry can grow without affecting seafood availability or needing more fish to be caught," says Dr Susan Marshall, leader of the Cyber-Marine programme.

"It also ensures that we can use all of the biomass grown through aquaculture, not just focus on the food portion. The challenge is how to efficiently extract everything from really diverse marine organisms that contain different types and combinations of the molecules, whilst not destroying one component to recover another." – *Tim McCready*

● **Case studies supplied by NZ Plant and Food Research**



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