KPMG

Agribusiness Agenda 2016

Volume 2:
Foresight to the future.

Part 1 of 2:
A global perspective.

KPMG New Zealand

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KIWIHARVEST

RESCUING FOOD • NOURISHING COMMUNITIES

In New Zealand homes alone $872 million dollars' worth of food is thrown away every year.

Globally, over a third of the food produced for human consumption gets lost or is wasted.

There is enough food wasted to feed the world's starving population. The world we live in has a massive disconnect with two major issues that can literally solve each other: hunger and food waste.

Globally, initiatives are being put in place to reduce food waste and end poverty. And New Zealand is playing its part, owing it to those who are starving and respecting the food that we have access to.

Kiwis with some true ingenuity have pieced together these critical issues and are starting to close that gap, one meal at a time.

A food rescue initiative has been set up as a distribution hub to connect the dots: KiwiHarvest.

KiwiHarvest, run out of Auckland (also associated with FoodShare in Dunedin), has been operating since 2015, collecting food from various sources (supermarkets, restaurants, wholesalers, farmers) and transporting it in their refrigerated van to charities and people in need. 100 percent of the food is distributed. KiwiHarvest aims to reduce the negative impacts of food waste on our environment by redistributing the excess food we have and helping to create lasting positive social change by nourishing those in need.

Every month KiwiHarvest delivers the equivalent of 20,000 meals to over 70 Auckland charities.

KiwiHarvest has a family of part and full time employees with very diverse backgrounds, sharing one passion, to feed the worlds staving population. They also need to rely heavily on the help of volunteers and donations, especially as they expand into more areas and experience growth.

Key partners include The Goodman Foundation and SKYCITY Auckland Community Trust. The largest food donors to KiwiHarvest are Countdown, Bidvest and Fonterra.

KPMG acts as a very proud in-kind partner. Suneil Connor, a KPMG Senior Manager, acts as a Director advising on finance, strategy and risk, and holds a position on the board, supporting KiwiHarvest with their exceptional growth and empowering efforts to give back to the community.

Welcome to life in the post-factual 21st century

By Ian Proudfoot
KPMG Global Head of Agribusiness

"We will tell you the truth, the whole truth and nothing but ... the part of the truth we agree with ... and if the truth is not to our liking, we will make something up we do like, and proclaim it as fact. It appears that nobody will ever hold us to account, so there is nothing to stop us."

I have found myself shouting at the television and radio more often in the last year than ever before. Firstly, I thought that this was just increasingly curmudgeonly behaviour as I move through my forties. However, it slowly dawned on me that, it was not me but them; the people – the politicians, analysts and experts – that were broadcasting at me that seemed to have detached themselves from reality and were, frankly, making things up to suit their arguments. Quoting facts seems to have become a creative pursuit for those that shape and lead societies most important conversations whether it be on the economy, the environment, immigration, international trade, security issues or any one of many other issues. Gossip and social media comments are reported as serious news, balance is out the window, and nobody is held to account for what they say.

The quest for a good sound bite is rapidly replacing substance in our world today. No longer do people spend hours working the statistics to suit their arguments. If they can't quickly Google up a piece of research that supports them, conventional wisdom appears to favour making something up (and eating humble pie later if you are fact-checked) over missing the opportunity to secure air time at six o'clock. Without the constraint of truth, we live in a more volatile, dangerous world. Incredibly complicated issues are simplified into 15 second stings or 140 character tweets; colouring people's opinions and, ultimately, shaping Government policy, investor behaviour and the consequences that follow.

Given the volatility and uncertainty surrounding our lives, we need deeper understanding and considered analysis more now than at any time in modern history. Inflammatory half-truths or fiction do not help the public see the whole story. Nor do they guide executives and directors to pursue optimal investments, or assist policymakers in reaching the right conclusions.

Why have we got to here?

It's illuminating to reflect back to November 2014, when we published the first globally focused *Agribusiness Agenda* titled *'Exploring our Global Future'*. This highlighted the major mega-forces that were accelerating the pace of change in our daily lives.

The slow recovery from the GFC had seen organisations in developed economies shy away from risk, impacting youth employment and leaving many people facing years of austerity. At the same time, emerging economies had achieved sustained strong growth, shifting the centre of economic power to the East; providing their populations with new freedoms and comparatively greater buying power than at any time in recent history. The income disparity between the most and least affluent people in the world continues to balloon; and with increased connectivity, this becomes more apparent to those at the lower end of the scale. We highlighted other megaforces such as rapid urbanisation, climate change, growing health issues linked to our modern lifestyles, and the emerging technologies that were reshaping how we lived; as well as the decreasing security we felt in our daily lives (from both physical and cyber threats).

We concluded that the level and speed of change was always going to challenge the foundations of our communities.

In late 2014, the 'post-factual response' to change was not as apparent from our leaders. Yet on reflecting on what has happened in the last two years, perhaps it is not surprising that 'hearing what you want to hear' has become so appealing.

ISIS had only appeared in our lexicon a month or so before we wrote the 2014 Agenda. We were in the midst of the West African Ebola epidemic, which was looking like it had the potential to become a global pandemic. We were still trying to understand the probable impacts on global financial systems and the Eurozone if Greece defaulted on its sovereign debt.

As the civil war intensified in Syria, we had yet to get our heads around the economic, political and social implications created by the scale of the migration towards Europe. We were yet to experience the emotional impacts of constant terror attacks being perpetrated in cities across the world by radicalised 'lone wolves'. The concept of Brexit and its resulting uncertainty, particularly on long-term investment plans, was still to come; as was the ongoing quantitative easing, negative interest rates and low inflation that stagnating economies have become so reliant on. Nor could we predict the emergence of Donald Trump, as potentially the next US President, complete with his isolationist, wall-building rhetoric.

Much has happened over the last two years that leaves people feeling less certain about their future. It is little wonder they are looking for 'leaders' that profess to have the answers. Those who tell us what we want to hear – rather than what we need to hear – have been making political gains around the world, regardless of the substance underlying their arguments. The vote in favour of Brexit was a clear demonstration of this. The 'out' campaign promised a new panacea for the UK, yet the morning after the voters had empowered them to deliver the promised future, they had no idea of the first step to take.

There can be no complacency in the face of the first global agrarian revolution

Amid so much change, there does remain a single constant that the agri-food sector is hanging onto; the basic human need to source sustenance from an external source. I regularly hear arguments that there will always be a market for our food products because people will always need to eat. There's also the continuing need for other products fundamental to our daily lives (such as clothes, housing and fuel) that have been largely or partially sourced from biological products grown around the world.

While it is true that people will always need sustenance, this does not necessarily mean it will be gained through eating and drinking the foods and beverages we know today. In future there is no guarantees that the forms of food historically produced by the farmer, grower or fisherman will still be in demand. The same goes for how timber, cotton, wool or rubber will be used into the future. Industry leaders who rely on the past to provide their stakeholders with assurances about the future are doing them the same disservice as some politicians and opinion leaders are doing to the wider community. That is, they are both providing a selective and tailored truth.

The ability to fuse physical, digital and biological technologies is unlocking new solutions almost daily. The potential to disrupt the most fundamental building blocks of our everyday lives is real – and there's simply no reason why the agri-food sector would be immune from this.

The reality for the sector is that it has always fused physical technologies (such a ploughs or tractors), biological elements (the plants or animals raised), with information (the intuition of the farmer) to grow food, fibre and timber. Its historic location at the confluence of the three strands of the fourth industrial revolution mean the agri-food sector must realistically expect the disruption it faces to be as great, if not greater, than any other sector of our economy.

I would go so far as to suggest that we are on the cusp of a global agrarian revolution. We are about to see transformational change across every aspect of how the sector works and what it produces.

Yet the level of complacency remains high across the agri-food sector, as the industry 'truths' are regularly discussed and defended.

'People will never eat a plant based burger in preference to a beef one.' 'The decimation of the woollen carpet market by synthetic alternatives could not be repeated in our sector.' 'We are the best in the world at growing milk; nobody can compete with high-volume, low-cost production.'

These statements largely rely on yesterday's realities. When we widen the lens of 'truth', the comfort provided by these beliefs is quickly eroded. What if the plant-based burger is scientifically proven to materially reduce the risk of heart disease or cancer, while still tasting and eating the same? What if the synthetic product alternative eliminated animal welfare issues, was better for the environment, used less water and was also natural? What if dairy powders are substituted with protein sourced from an insect or are grown from cultured cells that provide a more consistent product, reduce food safety risks, and are available 365-days-a-year?

Taking a broad perspective to future opportunities

In times of change, the perspective that we take to an issue is critical. If the field of vision is limited to what we want to see (or the truth we are comfortable with), we not only risk being destroyed by the disruption that is coming towards the industry at speed. We also risk missing the opportunity to respond to, join or lead the impending revolution.

So, what are the attributes needed to identify and deliver on those opportunities most likely to create sustainable success? It will require informed perspectives, balanced analysis, and a willingness to respond and adapt.

For leaders in the agri-food sector facing the greatest changes their industry has experienced in generations, they will need open minds. In guiding their organisation towards a prosperous future, they must be prepared to 'pull up the anchors' that have tied them to the deep traditions inherent within a conservative industry.

This report explores some of the emerging trends that should be on the radar. We explore new forms of food (such as algae, printed, nutraceutical, cultured and plant-based products); and the different ways these products will be grown, processed, distributed and re-purposed post-use.

It highlights the seeds of disruption that are apparent in the sector today. These are evolving at speed so it is important to continuously scan the horizon as new ideas and business models emerge that present new opportunities. You can be certain that the future will emerge differently from the way we describe it in this report. Some ideas will never be commercialised successfully, while some will remain niche because they are not able to be effectively scaled. Others will emerge faster and more extensively than we can comprehend today.

How can we re-shape the agri-food sector to meet the new realities of the world we will be living in tomorrow? It will require us to embrace change, to acknowledge the whole truth, and to avoid building walls around a legacy industry to preserve the unpreservable. If we can do this, we will be ready to capitalise on the exhilarating future that lies ahead for the sector.

Ian Proudfoot
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Recapping the mega-forces shaping the 21st-century

The *Agenda* released in November 2014, titled *Exploring our Global Future,* explored the mega-forces shaping the future, and the impact these forces would have on the global agri-food system.

It is not surprising that the mega-forces identified two years ago remain broadly the same today, and our analysis of these factors remains relevant. (If you wish to view the November 2014 report, it can be accessed via the *Agribusiness Agenda* page on www.kpmg.com/nz).

In presenting this 2016 edition of the *Agenda,* our aim is to more clearly articulate how we expect to see the agri-food system evolve. We've set out to answer the question – how are these emerging global trends going to impact the value chain? How will they change: the nature of a farm, farming practices, the products grown, the processing technologies, the consumer interface, and the way products are used? Those questions comprise the main themes explored in this *Agenda.* We also discuss the social and regulatory trends that are shaping the value chain.

We start by briefly recapping the mega-forces.

Theme

1

Challenging the global status quo

Geopolitical instabilities

Economic re-balancing

Government 3.0

This megatrend is driven by the shifts in economic and political influence, and the impact these are having on the public's perception of its own safety and security.

In 2014, we highlighted the slow recovery from the Global Financial Crisis, the growing economic influence of emerging nations, the rise in religious fundamentalism, the destabilising impact of cyber terrorism, and the challenges that Governments face regulating against problems that no longer exist solely within their sovereign borders. These trends are creating a world that is less trusting and more uncertain. This is best illustrated by the various repercussions of the civil war in Syria. There is the failure of the UN to secure a ceasefire, given the deepening political divisions in the Security Council; as well as the growing fear of ethnic and religious difference. Most obviously, there are the major social and political impacts arising from the wave of refugees across the Middle East and Europe. We continue to see this uncertainty and lack of trust shaping the way communities and economies evolve and interact with each other.

Theme

2

Future world citizens

21st-century consumer

The ageing generation

Integrated urban living

In our 2014 report, we suggested the world will be shaped by three key emerging demographic groups. The first is the hyper-connected consumer who seeks instantaneous access to the latest solutions via various digital platforms. The second is the expanding cohort of senior citizens facing life managing chronic health issues, albeit equipped with financial resources. The third group is the rapidly-burgeoning urban population; swelled by rural people seeking a better life in the city but ultimately facing the reality of living in crowded, sprawling metropolitan regions. Companies are designing products to appeal to these core demographics; whether it's a digital platform aiming to provide millennials instant access to products and services, or solutions designed to complement the lifestyles of ageing consumers, or compact appliances and new forms of social interaction for urban communities. While the challenges of ageing populations are a particular focus for developed nation Governments, all three demographics are having a major impact on how societies are developing in emerging economies.

Theme

3

Empowering infrastructure

New wellness models

Lower energy intensity

Targeted education

The ability of a society to realise its potential is directly linked to the effectiveness of the social infrastructure it is built on. Under this theme we explored three significant infrastructure areas – healthcare, energy, education – and the impact they have in shaping our future communities. The spiralling cost of healthcare is driving the trend towards preventative health management; something which is becoming increasingly apparent as Governments seek policy responses to address lifestyle, health and obesity issues. The ratification of the Paris Climate Summit goals has set the world on an irreversible course to a low-carbon future, refocusing attention on the use of fossil fuels and accelerating the search for sustainable energy alternatives. A high-performing education system underpins a growing, vibrant economy; technology is unleashing the benefits of global education to a wider audience more now than at any time in history. Long-term growth will be underpinned by innovative delivery in meeting these key societal needs.

Theme

4

A connected and converging digital world

Fusion revolution

Realising value in data

In 2014, the *Agenda* reported experts suggesting the world was in the formative stages of a digital revolution. The internet of things had recently come into our lexicon, but what was less apparent was the exponential speed at which machine learning and artificial intelligence was developing. The speed of development has led the World Economic Forum to declare 2016 the start of the Fourth Industrial Revolution, a revolution based on the fusion of physical, digital and biological technologies. As change accelerates it has become clear that the impacts of diffused innovation, the wide application of digital technologies, are more fundamental and transformational in nature than we could have envisaged two years ago. We have consequently evolved the megaforce to reflect the transformational solutions the **Fusion Revolution** is delivering to the world. Realising the value of data grows in relevance as it has become easier to create and collect data. The challenge now facing organisations is securing the talent necessary to unlock the insights hidden in their data.

Theme

5

Enabling indefinite sustainable living

Climate changing

Facing resource scarcity

Social enterprise

Last year, the United Nations set 17 Sustainable Development Goals (SDGs) for the global community to collectively work towards in eliminating the poverty, malnutrition and neglect inherent in our society. Many of these goals revolve around using the planet's resources in a balanced, sustainable manner. Initiatives such as the SDGs and the Paris Climate Change Accord indicate an emerging awareness of the need to shift towards securing a more sustainable future for all. There is little doubt that the impact of the changing climate and the constraints of resource scarcity will significantly influence some of the more disruptive innovation in the coming years. It also appears likely that much of this innovation is going to be developed and commercialised by businesses that have a wider purpose than purely profit. We can expect to see significant growth in the scale and impact of social enterprises on all aspects of daily life, fuelled by entrepreneurs with a desire to not just make money but to make a difference.

The changing nature of a farm

For most people in the developed world, their minds image of a farm is the one they were exposed to as kids – the farmer in the farmyard (or driving his tractor), dogs in tow and a plethora of different animals living happily in harmony.

This stereotypical farm never really reflected the reality of most farms around the world; farms are generally small (less than 1 hectare), have been operated by a family largely to provide food for subsistence and have used minimal, primitive technologies.

With the world still struggling to feed itself, recent estimates suggest that 795 million people (11 percent of the global population[1]) are chronically undernourished, it is no longer possible to rely on predominately subsistence agricultural practices to produce sufficient safe food to meet current food demands.

Farms are changing faster today than at any point in history, driven by the need to produce significantly more food to supply a growing and increasingly hungry global population. The challenge is not just producing more, but doing it in a sustainable and ethical way.

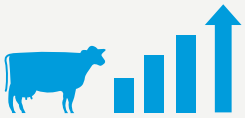
Conventional wisdom has been that more food is produced by increasing scale, consolidating family farms into broad-acre farms or large scale pastoral operations, or utilising feed-lots, or housing animals in barns. These intensive systems, which are very different to the stereotypical farm, have raised many concerns for consumers;

- they don't like their impact on the environment and water quality;
- they have concerns over the welfare of animals; and
- they have questioned the nutritional quality of the food being produced.

This is before they think about the impact these systems have on rural communities, the risks of consolidating production in a single geographical area or the environmental footprint associated with distributing the product.

As a consequence the search is on for new farming models, focused on meeting the nutritional needs of the population while better utilising natural resources and embedding food production closer to those that will ultimately eat the food.

1 http://www.worldhunger.org/2015-world-hunger-and-poverty-facts-and-statistics/



570 million

Estimated total farms in the world[2]

4%
of these farms are in high income countries.

49%
of these farms are in lower middle income countries.

China has the largest agricultural area:

525 million

hectares

The next largest is:
Australia = 456m hectares
USA = 414m hectares

72%
of farms globally are less than 1 hectare.

6%
of farms globally are larger than 5 hectares.

201 million

or 35% of these farms are in China

138 million

or 24% of these farms are in India

There are approximately:

25 million

farms in Indonesia

The next largest is:
Russia = 23 million farms
Bangladesh = 15 million farms

90%

of the world's farms are estimated to be operated by families.

75%

They are estimated to farm 75% of agricultural land globally.

(Graphic above) 2 http://www.sciencedirect.com/science/article/pii/S0305750X15002703

Cultured farming offers an opportunity for safer, more sustainable food

SHAPING MEGAFORCES

New wellness models

Lower energy intensity

Fusion revolution

Facing resource scarcity

The 'Maastricht Burger' grown and introduced to the world by Professor Mark Post and his team at the University of Maastricht in August 2013 gave the world a first indication of the opportunity inherent in cultured farming.

The first burger received mixed reviews, it was lacking the natural fat in beef which impacted the eating experience, but it was apparent that it was a step forward in the quest for sustainable meat.

Professor Post talks about a vision that within the next 20 years all the beef the world needs is grown from a small herd of cattle, utilising an embedded farming system that enables consumers to grow cellular fresh beef when they want a steak, burger or beef roast.

The rapidly evolving field of cultured farming may ultimately give the world the ability to grow as much animal protein as it wants to eat from cells rather than growing the whole animal. The process involves harvesting animal cells and placing them in a nutrient mixture that allows them to grow into pure muscle tissue. This is not mock meat, but real meat grown without the animals.

It is not just meat, innovators are working on, but also milk without cows and eggs without hens.

The not for profit research organisation, **New Harvest**, suggests cellular agriculture offers the potential to build a post-animal bioeconomy where we harvest animal products from cell cultures, not animals, to feed a growing global population sustainably and affordably.[3]

Think about growing all the meat, milk and eggs the world needs without animal welfare, effluent or environmental issues.

Think about growing these foods without by-products that contribute little or nothing to the economics of a farming system. Think about producing food in facilities were safety and security are more tightly managed than natural farming systems, delivering consumers more confidence over food quality.

Cultured farming may address many of the concerns that consumers have over higher intensity farming systems but it is by no means certain that they will quickly accept a product that many would see as being unnatural. The innovators recognise this and are focusing on the sustainable attributes of their products as they prepare for launch, for example:

– **Perfect Day Foods** is working towards launching animal free dairy products in 2017 and describes its mission as "empowering you to enjoy the dairy foods you love while making the world a kinder, greener place. Zero compromise required."[4]

– **Memphis Meats** have grown and cooked a cultured meat meatball, are fusing Silicon Valley innovation with the culinary traditions of the America's southern states, "to farm real meat cells–without the animals–in a process that is healthier, safer, and more sustainable than conventional animal agriculture."[5]

There are already products in the market that have been developed using cultured solutions. **Soylent**, the new nutrition company claiming to make the world's most nutritionally balanced food, notes all its products use "bioengineered algae as a source of lipids and essential omega fatty acids."[6] The algae is farmed in bioreactors, enabling the organisms to be grown using less resource than traditional farming methods.

Implication: When synthetic carpets were introduced many argued that consumers would never buy a nylon carpet in preference to a wool one. Today less than 5 percent of carpets sold worldwide are woollen. **Price, quality and ethics will ultimately drive demand for cultured food products.**

3 http://www.new-harvest.org/about
4 http://www.perfectdayfoods.com/our-story/
5 http://www.memphismeats.com/about-us/
6 http://www.soylent.com/

54%

of the global population currently lives in urban areas expected to grow to 70% by 2050.

1900

London was the only city with a population over 5 million.

1950

New York was the only city with a population over 10 million.

37

urban regions with populations exceeding 10 million today. 700 million people live in these regions (10% of the global population).

Urban farming can reconnect cities to fresh, sustainable food

SHAPING MEGAFORCES

As more people live in cities every week the challenge of delivering sufficient safe, nutritious, sustainable food to urban populations continuously grows. Organisations are exploring opportunities to embed agricultural practices in urban areas with a goal of delivering local, sustainably produced food to consumers.

This could take the form of commercial production in sky farms on top of offices or supermarkets, communal allotment areas (which could be located on grass verges due to lack of space), edible borders in parks and gardens, living walls on buildings or social food projects set up to support disadvantaged communities.

Urban farming is about supplying fresh product, minimising environmental impacts, contributing to greener more sustainable cities, connecting people to their food and, for many urban farmers, providing access to food or opportunity to disadvantaged members of the community.

– Social farming organisations exist around the world; one example being **Soul Food Street Farms** in Vancouver which transforms vacant urban land into artisan fruit and vegetable farms. Soul Food describes its mission as "empower[ing] individuals with limited resources by providing jobs, agricultural training and inclusion in a supportive community of farmers and food lovers."[7]
– Europe's largest urban farm has been built on top of a building in The Hague by urban farming specialist, UF. The commercial farm, **UF de Schilde**, includes a 1,200 square meter rooftop glasshouse and a tilapia farm one floor below. The farm is expected to produce 45 tons of vegetables and 19 tons of fish annually which will be sold to the local community.[8]
– Another example is **LA Urban Farms**, which provides farmers with Garden Towers they can utilise to grow vegetables, fruits, herbs and edible plants. Their farmer partners include chefs that use the fresh local produce on their menus, commercial operators and residential developments.[9]

Vertical farming innovations

Urban farming systems are increasingly utilising new technologies to enhance both the yield and quality of the produce they can grow. Vertical farming systems use technology to tightly control environmental factors including pests, light, animals, disease, fungus, weather to enable all year production. This is achieved through fusing intensive digitally controlled indoor farming LED lighting systems with biological innovations in irrigation systems and growing media.

The farms are found in old high rise buildings (for instance **Green Sense Farms** in Illinois[10]) and disused bomb shelters underground in London (**Growing Underground**).[11] They can be in any space, anywhere consumers are looking for fresh, natural food.

– **AeroFarms** of New Jersey are building one of the largest vertical farms which will ultimately produce nearly a million kilos of leafy greens using aeroponic mist technologies that sprays nutrients onto crops being grown in vertical stacks without soil, sunlight or water.[12]

Implication: Farming is no longer confined to traditional farms but can be conducted anywhere. Urban farming businesses will be established with multiple social and commercial objectives, but **they will all be focused on delivering sustainable local food**, thus making them strong competitors for traditional producers.

7 http://solefoodfarms.com/
8 http://www.ecowatch.com/inside-eu-ropes-largest-urban-farm-1891126795.html
9 http://laurbanfarms.com/
10 http://www.greensensefarms.com/
11 http://growing-underground.com/
12 http://aerofarms.com/

Realising the potential of blue larder

SHAPING MEGAFORCES


Government 3.0


New wellness models


Climate changing


Facing resource scarcity

As urban populations grow, the pressure on land based farming systems to produce sufficient food to meet consumer demand increases, particularly as the most productive land is often the land most suited to intensive urban development. As a consequence, there will be a need to increasingly look to the ocean to provide a much greater proportion of the global food supply.

Historically, the blue larder has been used to provide fish and shellfish (caught wild or cultivated) and some plant products (like kelps and other types of seaweeds). Our utilisation of the ocean for food has been constrained to a fraction of its potential because of the ease of producing food on land and the practical challenges associated with working and farming at sea. In the future it will become a primary source of farmed food.

As a consequence greater investment will be made into understanding the nutrition and health properties inherent within more of the species that call the ocean home.

Many forms of micro-algae that thrive in the ocean have been identified in recent years and have been found to be rich sources of nutrients and antioxidants. One example which has migrated into mainstream diets in recent years is Spirulina (a blue green algae, cyanobacterium, produced from seaweed) which is being extensively used as a dietary supplement for both humans and animals.

Innovation will be required to enable the blue larder to be extensively farmed in a sustainable manner. As our diet becomes increasingly aquatic the chances of the farm being in middle of (or under) the ocean increases. For example, algaculture, or the farming of algae, is evolving around the world, producing not only nutrients for human consumption, but stock feed for animals and a potential input into biofuel production.

Growing on the sea with floating farms

Recognising constraints on premium agricultural land, floating farms, not just for aquaculture but dairy and other livestock farming, horticulture and cropping, are becoming a reality. Using the ocean to create space for the production of food is an obvious response to the loss of productive agricultural land. We expect the development of ocean farms will not be restricted to floating farms as innovation with underwater farming systems accelerates. One example being **Nemo's Garden**, an Italian company developing intelligent, undersea biospheres, in which they are currently growing herbs.[13]

Floating farms can be located close to many mega-cities or any populated area with access to water, enabling them to enhance locally grown food options. They provide food which can be grown without the impacts of many pollutants that are found in the land based environment around cities, creating the opportunity to deliver healthier food. The systems can also be designed to utilise easily available renewable energy sources (tidal, wind, solar) reducing the carbon footprint of the products.

Implication: The cost of securing cultivatable land will see farming activities move to offshore systems, as we learn how to capture the full nutritional potential of the blue larder.

13 http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-14-life-below-water.html

Other emerging themes...

Social enterprise farming.

We are increasingly noting farming businesses being set up with a social purpose. In some cases these enterprises are created solely to address a social issue, be this feeding a specific community, addressing a health issue or making a contribution to feeding the 795 million undernourished people in the world. However, it is more common to find businesses being established with a dual lens, to both respond to a social issue and to make a commercial return. Social enterprise agri-food businesses will do things differently; they clearly understand their reason for being and are driven by a different set of metrics which will make them challenging competitors. They are also more likely to identify and adopt innovation and as a consequence disrupt the traditional way things have been done.

Crowd sourced farming.

Using technology to redesign commercial models is reshaping how organisations interact with each other and consumers around the world. Farming activities are not immune and producers around the world are looking for ways to use digital solutions to reengineer their farming operations to better tailor production to the needs and demands of the consumers of the products they produce. There are farmers that have established crowd sourced models where they seek consumers prepared to make financial commitments to buy the products they will produce in advance of the product being grown. Such approaches can enhance a farm's financial viability (payment can be received for stock in advance of production), minimise waste by aligning production to demand and more clearly connect the consumer with their food. An example is **True Grass Farms,** where consumers buy a part interest in an animal to be reared and receive their share of the food produced from that animal once it has been slaughtered.[14]

Sharing comes to farming.

Having redefined the taxi and accommodation sector it is not surprising that enterprising farmers are thinking about the potential to **Rent-a-Ruminant** (this company supply goats that provide eco-friendly vegetation management services)[15] or a chicken, or a sheep, or some bees or (even) a bird of prey. Connecting people with their food, providing sustainable environmental management services (say weed control or pest eradication) or just enabling a farmer to economically manage a larger number of animals than is possible on their own land, we should not overlook the 'uberisation' of farming particularly in emerging markets.

The emergence of new financial investors.

Previous *Agenda* publications have highlighted the concerns that many professional, financial investors have historically had about investing into primary sector assets; the inherent volatility driven by commodity price shifts and weather does not deliver the consistent return patterns that financial investors seek. However, the global food story is attracting more non-traditional investors to the sector, with pension, private equity and sovereign wealth funds all seeking to take more active investment positions in primary sector assets. They are however bringing different expectations to farming businesses; around management practices, reporting, risk management and an investment time horizon that includes a clear intention to liquidate investments at a defined point in the future. As professional investors become more active in the sector, farm management practices will evolve to create a new category of farming business that meets the needs of the investment life-cycle.

14 http://truegrassfarms.com/
15 http://www.rentaruminant.com/

Changes in how we farm

Prehistoric people spent much of their lives hunting or gathering food. Over time, the human pursuit of food has shifted broadly from collection to the cultivation of food – yet the true essence of farming has not changed substantively for centuries.

Farmers have always cultivated plants, raised animals, planted trees or harvested the oceans; in order to provide food, fibre or fuel.

Farmers and producers are naturally innovative, and have always made enhancements that deliver year-on-year incremental improvements in yields. There is something very significant, however, about the level of investment currently being made into new agri-food technologies. We appear to be on the cusp of a major step change – not only in productivity; but in challenging the very fundamentals of how, where and when we sustainably grow food, fibre and timber.

This is best illustrated by the wave of investment into innovative agri-food businesses. Many organisations are looking to deliver a range of technological solutions to producers that:

- integrate digital solutions into farming systems to augment the intuition of the farmers and producers;
- increase the precision application of nutrients and other inputs into a farm to enhance yields, while minimising the environmental impact of farming;
- take advantage of developments occurring in unmanned vehicles, both on the land and in the air;
- enhance animal genetics, nutrition and health to improve productivity, while being alert to consumer concerns about the use of genetically modified organisms in food; and
- develop tools to enable previously unproductive regions to contribute more via water capture technologies, cultivars and evolved farming techniques.

The potential for disruptive change is best illustrated by the increase in investment in these technologies over the last 10 years. In 2005, it was estimated that agri-tech investments amounted to around US$100 million. This figure had grown to US$4.2 billion for the 2015 year. Clearly, the markets had recognised the opportunities available to disrupt traditional agri-food practices, and deliver solutions that address the issues facing the global food system.

Reports suggest the agricultural robotics industry is now serving a

US$3 billion

market which will grow to US$10 billion by 2022[16]

Thousands of robotic milking parlours have been installed worldwide, creating a

US$1.9 billion

industry that is projected to grow to US$8.5 billion by 2026

Fresh fruit harvesting

A limited number of fresh strawberry harvesters are already being commercially trialled, while fresh apple and citrus harvesters have also reached the level of late stage prototyping. Market adoption will start from 2021 onwards, reaching US$230 million by 2026.

US$485 million

Autonomous drones have been providing detailed aerial maps of farms, enabling farmers to take data-driven, site-specific action. Agriculture will be a major market for drones, reaching US$485 million in 2026.

300,000 tractors

More than 300,000 autonomous tractors equipped with autosteer or tractor guidance will be sold in 2016.

Robotic weeding

Vision-enabled robotic implements have been in commercial use for some years in organic farming. These implements follow the crop rows, identify the weeds, and aid with mechanical hoeing. This will become a US$380 million market by 2026.[15]

(Graphic above) 16 Agricultural Robots and Drones 2016-2026: Technologies, Markets, Players, The future of farming; ultra precision farming; autonomous farming; future of agrochemicals, August 2016.
http://www.idtechex.com/research/reports/robotics-2016-2026-000458.asp?viewopt=contents

Big data and analytics augment experience

SHAPING MEGAFORCES

- Government 3.0
- Realising value in data
- Climate changing
- Facing resource scarcity

With the trend towards data-driven agriculture, farmers and producers are discovering innovative ways to be able to grow more with less.

Traditionally, the agri-food sector has been a slow adopter of digital technologies. Various reasons have been suggested for this, including challenges with connectivity in rural areas, the resistance of farmers to change, but also a lack of practical solutions being available. These barriers are now being overcome. Rural connectivity is being addressed in many countries as the economic and social potential of high-speed broadband is recognised. Resistance to change is reducing as the industry enters a period of generational change, but also as the financial and environmental benefits of digitally-augmented farming become more apparent. The shortage of solutions diminishes as demand grows.

We're seeing rapid growth in the application of precision farming technologies. By enabling the precise quantification of an input (be that water, fertiliser or chemical) to be applied to specific areas, farmers can simultaneously reduce costs and enhance production yields. Data from various sources – including high-resolution satellite imagery, meteorological records, soil nutrient sensors, water flow gauges and production reports – can be integrated and analysed by algorithms to produce highly specific recommendations that not only enhance production but also improve environmental outcomes.

Embedding sensors across production systems – be they pastoral, horticultural, or any other form of biological production – will be a game-changer in capturing the production potential of land of any size. Delivering what is possible relies on recruiting highly-skilled people that can ask the questions that need answers, comb the terabytes of data to identify the gems of insights that can deliver the game-changer, and build the algorithms able to augment the intuition of those operating the system.

In California, **The Climate Corporation**[17] has built a data analytics platform that utilises weather, soil and field data to provide farmers with recommendations tailored to their specific paddocks to improve yields. It is also creating a platform that can provide tailored weather insurance products to farmers. Companies like Canada's **Farmers Edge**[18] or **ReGen**[19] in New Zealand are also combing data to provide fully-integrated solutions that help improve sustainability, efficiency and productivity. **The Yield**[20] from Australia is utilising sensor technologies in oyster farming systems in Tasmania to improve production and manage risks that arise from contaminants in the water.

Unlocking such valuable insights is not easy and there are challenges to be overcome. Aside from connectivity, there are major issues to be addressed surrounding data ownership. The most significant benefits will be gained by integrating multiple data streams. However, this is only possible when individuals and groups are confident their data will not be used to disadvantage them economically. As the sheer volume of data grows exponentially, ethical principles surrounding data ownership urgently need clarification.

A 'rough measure approach' is no longer good enough in a world where agri-food producers are expected to produce ever-greater output while operating within the limits that communities and consumers impose on them. In order to demonstrate and verify the integrity and efficacy of their products, producers will increasingly embrace the integration of GPS technology, IoT sensor technologies, precision applicators, autonomous vehicles and other mainstream technology innovations to demonstrate their compliance with regulations.

Implications: Producers that are slow to utilise data to augment intuition will ultimately struggle to meet wider public expectation and deliver sufficient output to remain economically viable.

17 https://www.climate.com/
18 http://www.farmersedge.ca/
19 http://www.regenerated.co.nz/
20 http://www.theyield.com/

Organic and biological farming systems emerge into the agri-food mainstream

SHAPING MEGAFORCES

- 21st-century consumer
- Integrated urban living
- New wellness models
- Climate changing

Throughout history, many dedicated producers have sought to adopt organic farming practices. These are broadly defined as systems that are managed to maximise soil fertility and minimise adverse impact on the local ecosystems.

Designing a farming system that effectively marries sustainability with productivity presents a range of challenges. The key skill in organic farming systems – which some, but not all practitioners achieve – is to make the land productive in an environmentally and economically sustainable way.

Organic farming tends to polarise thinking. One camp argues that widespread adoption of organic practices will starve half the world, while the other sees it as the track towards healthier, safer, more environmentally-sustainable food. The key question is whether organic produce represents a 'need to have' or a 'nice to have' for consumers. What is the elasticity of demand?

Market volatility, particularly as premium organic purchases are discretionary to most consumers, has meant demand has peaked and troughed with economic cycles. As we understand more about the toxins and carcinogens that permeate our daily lives, however, the commitment of many consumers to organic and biological products appears to be building. With the concerns that high-value customers have about the safety and nutritional quality of their food – together with innovation in how products are branded and marketed to consumers – evidence indicates this is creating a less elastic demand profile for these products.

The arguments around lower yield also appear to be reducing, as the organic sector increasingly benefits from digital and precision technologies benefiting mainstream farmers.

Organic farming is practised in more than 162 countries across the globe. In 2014, the global market for organic food was estimated at US$80 billion. This compares with US$17.9 billion in 2000. This suggests the industry has grown at a compound rate of approximately 11 percent per annum this century.[21]

Findings from the 2016 **Aotearoa NZ Organics Market Report**[21] suggest the demand for certified organic produce represents a sustained global shift in consumer consciousness, particularly in premium markets. The key challenge facing organic and biological producers is developing systems capable of fulfilling the growing demand for their product, as mainstream supermarkets, restaurants and food service operators look to fulfil consumer requirements and incorporate organic products into their year-round offering.

Fighting 'bug with bug' to protect crops and control biosecurity

Concerns about the levels of chemicals and fertilisers being used to protect crops are encouraging many farmers to look for natural ways to raise crops, manage disease and respond to biosecurity incursions. Natural biological control agents include insects (such as wasps) that prey on disease carriers, or bacteria that counter an infestation or deliver disease immunity to a plant. Use of these agents will be prioritised around the world to provide protection more in tune with the preservation of biodiversity and production of safe food.

Implications: Farming systems producing organic and biological products become more common as these products move into the mainstream, driven by more stable demand and major retailers seeking to expand their range.

21 http://www.oanz.org/publications/reports.html

Valuing the scarcity of every last drop of water

SHAPING MEGAFORCES

Fusion revolution

Climate changing

Facing resource scarcity

Social enterprise

The planet's supply of fresh water is largely finite, yet the demand for water increases as society urbanises, wealth grows, and people look to eat different and more complex foods. The challenge facing the global community to provide a secure, safe water supply to every citizen is significant. Today, 2.3 billion people do not have access to adequate sanitation and more than 650 million have no access to safe drinking water.[22]

The global agri-food system utilises 70 percent of the planet's fresh water. As a consequence, there is a growing focus on how it is using water and the production footprint it leaves. Producers are innovating with technologies used to manage water, grow crops and, in some cases, changing the crops they choose to grow. (This is explored further in the following section, *Changes in what we grow*).

For those of us living in temperate regions, it can be difficult to recognise the extent of water stress facing the world. Research suggests that 43 countries are currently experiencing severe water scarcity, and estimates that half the global population could be living in areas of high water stress by 2030.

Countries facing water stress have less than 1.7 million litres of fresh water per person per year; severe scarcity occurs in countries with less than 500,000 litres per person.[23]

How many times have we heard arguments that the scarcity of water makes it the new oil? The sustained reduction in oil prices in recent years gives weight to the argument that the economic and political power afforded to oil producers is diminishing. Major producers continuing to pump oil at depressed prices suggests they are cashing up reserves quickly as the world shifts into a post-fossil-fuel, low carbon environment.

If water does become the new oil, the focus on its use will only increase. The agri-food sector will need to ensure it makes every drop of water count. Designing systems and deploying digital and analytic technologies that allow farmers to understand their water availability, and utilise it with precision, is critical. Many technology companies are already focusing on delivering solutions in this area. For example, **Welintel** has developed sensing systems that show producers what is happening to their groundwater, and plan pumping and irrigation to maximise the benefits they derive from water.[24] Other systems support irrigation decision-making and enable the precision application of water.

Efforts need to extend beyond digital technology, however. Work will accelerate on the genetics of plants to help them to thrive in arid, hostile climates. There will also be significant developments in condensing technologies that are able to extract water from the atmosphere. Analysis indicates there could be 11.5 millilitres of water in each cubic meter of oxygen in a desert environment, offering the potential to produce water out of thin air in the most hostile regions of the world.

The customer response is also apparent; **US clothing giant Levi's** has targeted water use as a critical issue for their businesses. Five years ago, the company initiated a drive to reduce water use in its supply chain without compromising quality. It is now using 96 percent less water in making a pair of jeans, far less than the industry average of 11,000 litres.[25] Achieving such results requires action throughout the value chain. Similarly, the agri-food sector needs to be able to demonstrate its actions and quantify the improvements it is delivering.

Implications: The agri-food sector will be made accountable for water resources as scarcity grows; forcing producers to innovate around how they source and apply water, and potentially the products they grow.

22 https://assets.kpmg.com/content/dam/kpmg/nz/pdf/cyclewater-aug-kpmg-nz.pdf

23 http://www.un.org/waterforlifedecade/scarcity.shtml

24 http://www.wellntel.com/

25 http://www.bbc.com/news/business-35613148

Other emerging themes...

UAV's or drones deliver aerial solutions.

Recognising the potential inherent within UAV technology requires a shift in thinking – from operating a single lightweight drone to envisaging the use of a swarm of 10 or 20 heavyweight UAV craft. They will have the capability to do tasks beyond the power of a single vehicle (e.g., lifting, spreading, mustering, pruning, spraying), and to do it faster, cheaper and more safely than traditional on-farm techniques. At the same time, they will be able to conduct aerial observations of the land and collect data from remote sensors, delivering more timely data to support other decision-making systems. The regulatory impediment that will exist on UAVs in cities is likely to be less burdensome in rural areas, making them a game-changer for farm operators. The cost and skills required to operate UAV technologies may remain a constraint, offering opportunities to develop new pay-for-access business models.

Robotics and other world class manufacturing practices.

Many of the issues facing growers of biological products are the same as those facing any production-focused business. They must attract and retain people to do sometimes repetitive work, improve productivity, deliver consistent quality, minimise wastage, and reduce working capital tied up in inventory, to name but a few. To address these issues, businesses have long been implementing continuous improvement practices like Six Sigma, adopting just-in-time manufacturing processes and other best-in-class practices. Increasingly, they are exploring the adoption of robotic technologies. The agri-food sector has been slow to see the opportunities inherent in these practices, but we expect them to become as common in agriculture as they are elsewhere in the economy, with transformational impacts on both the environment and productivity. Imagine a robot that can harvest fruit 24-hours-a-day, handle it carefully, integrate it with logistics and packing systems, and ultimately deliver greater volumes at a faster speed to market. Or a robot that is able to deliver ultra-targeted weed control while also identifying areas in the crop that are under-yielding, in order to prompt corrective action.

Farming without antibiotics.

Increasing resistance to antibiotics is one of the biggest threats faced by the human race today. Diseases and infections that have been easily treated in the past are starting to result in death and disability. This is having a huge impact on families, communities and Governments around the world, and it is not surprising that blame is being spread. One finger is pointed squarely at the agri-food system's use of antibiotics to manage animal health as a key contributor to growing resistance, despite the sector using less than 20 percent of all antibiotics consumed globally. Concerns around antimicrobial resistance are resulting in consumers and food retailers increasingly demanding antibiotic-free food. Eventually, farmers will need to learn to farm without antibiotics. This will influence stock levels, as well as where and what is grown, but in the short term at least, premiums may be available for certified antibiotic-free food. The need to remove antibiotics from farming systems will not only drive focus on animal management practices, but also on areas such as biosecurity, genetics and natural health remedies.

Now you can have another one just like that one.

Just over 20 years ago, the ability to exactly replicate an animal or any biological species through cloning was a scientific breakthrough. In 2016, it can be done on an industrial scale, with research indicating that cloned animals are not ageing any differently from traditionally conceived animals. Genetic diversity may be compromised, but speed and certainty are accelerating the uptake of cloning technologies. It is not only animals that will be cloned. The ability to engineer plants for phytoremediation or biofuel research often involves complex design and assembly of DNA elements that require advanced cloning tools. Cloning allows growers to mass-produce plants that may be difficult to grow from seed.

Changes in what we grow

As the world's population grows in size and wealth, producers will be required to continuously reassess the products that they grow, catch or harvest, and present to the market.

What we eat today differs significantly from the food that was eaten 50 years ago. The major fast-food operators – the likes of McDonalds (founded in 1955 and now has 36,000 stores in 119 countries) , Pizza Hut (1958) and Starbucks (1971) – have been joined by numerous other quick-service food chains and multi-national retailers. These operators have fundamentally changed prevailing diets in some countries, and brought diversity to others. Suggesting that the UK's preferred national dish was a chicken tikka masala would have raised eyebrows in 1960s Britain, but by 2001 it was easily accepted as a reality in a more diverse, multi-cultural country.

Technological evolution also has a major impact in shaping demand for products. This is well-illustrated by the challenges faced by the coarse wool industry since the 1950s, when synthetic fibres were introduced into carpets.

Failure to acknowledge the implications of changing technologies can leave an industry with a stranded capacity and product in a declining industry.

In another 50 years time, we can expect the global population will be eating food that has evolved again in significant and dramatic ways. With forces shaping the global agri-food systems – including the practical implications of climate change, natural resource constraints, growing health concerns, new technologies, and the evolution of fashion and lifestyle trends – producers will need new strategies that allow them to remain relevant and prosperous. While you may be a world-class producer in your sector today, understanding how that product will be used into the future is critical to making long-term strategic planning and investment decisions.

For those currently invested in the sugar industry, for instance, recognising the implications of concerns around obesity and the resulting public policy positions should shape thinking around diversification. For those in the dairy sector, recognising that many countries face serious water stress should shape decisions whether to invest in a new powder dryer or a liquid processing plant.

Litres of water used to provide....

1kg of beef:

15,000 Litres

1kg of chicken:

4,325 Litres

1kg of tomato's:

215 Litres

x1 250ml glass of milk:

225 Litres

x1 egg:

196

Litres

x1 250ml glass of wine:

109

Litres

x1 250ml glass of beer:

74

Litres

1kg of cheese:

3,178

Litres

1kg of apples:

822

Litres

1kg of cabbage:

237

Litres

(Graphic above)26 https://docs.google.com/spreadsheets/d/1nzLDn1LbiwVe2TL4y4kiejuUQKplx4Z3R5GHOguwvmo/edit#gid=0

Dietary diversity expands around the world

SHAPING MEGAFORCES

Geopolitical instabilities

Economic rebalancing

21st-century consumer

Integrated urban living

Over the next 20-30 years, billions of consumers will have the opportunity to develop a palate that is more eclectic and cosmopolitan than at any time in recorded history.

As these consumers grow their personal wealth, they will seek to experience new tastes and greater ethnic diversity in the foods they choose to enjoy. It is likely there will always be a place on the menu for a storied, grass-fed, hormone-free, GE-free, antibiotic-free steak; or a world renowned glass of red wine. However the expectation held by many Western food producers that growing wealth would equate with a desire to transition to a Western-style diet – heavy in dairy, red meat and sugar – is starting to look increasingly erroneous. Evidence suggests emerging consumers are steering away from Western food trends and augmenting their traditional diet with carefully selected premium products offering new tastes and experiences.

Emerging markets are not necessarily adopting a Western diet. This is probably best illustrated by the Japanese diet, which retains its unique traits despite Japan's emergence as a global economic powerhouse.

Meanwhile there is a 'culinary diaspora' of Chinese, Indian, Vietnamese, Middle Eastern, Mexican and African cuisines spreading across the globe; gaining popularity not only for their taste but also the cultural experiences they deliver to diners.

Bernard Salt of KPMG Australia calls it 'the Bok Choy Effect'; the growing ethnic diversity in our daily diet as the population globalises and gains the confidence to experiment with different styles of food. This is shifting the global demand for food and creating new market opportunities for producers. Consumers in the West continue to seek fashionable new products; while consumers in emerging markets look for authentic, storied proteins to add to their diets to demonstrate their growing wealth, influence and sophistication. Both groups will be willing to pay a premium to secure authentic experiences.

A good example of this is the growth in demand for Asian-influenced foods in the United States – a sector which has grown at faster rates than more traditional American fare. The shift towards Asian-based cuisine aligns with the growing demand for healthy, fresh alternatives that are also fast and portable (such as the fresh sushi available in many cafés and supermarkets). The Chinese American Restaurant Association notes there are over 45,000 Chinese restaurants across the US; a number that exceeds all the McDonald's, KFCs, Pizza Huts, Taco Bells and Wendy's in the country.[27]

However, while our diets will diversify and evolve, there will also be 'safe harbours' that remain. In a world that is changing and disrupting, many consumers will seek comfort from the foods they knew as children. It would be foolish to overlook the value consumers will attach to those foods they have known and enjoyed their whole life.

There are other implications arising from the significant influx of refugees many countries are currently responding to. One of the few things many migrants have been able to bring with them is their food culture. With support from social entrepreneurs, food businesses are being established to leverage this experience; adding further diversity to the diet of host countries, and enabling migrant groups to preserve at least one element of the lifestyle they have been forced to leave behind. A good example is **Eat Offbeat**, a food delivery company based in New York City.[28]

Implications: Consumer demand will mean what is grown today will not necessarily be sought out by consumers in the future; being close to ethnographic trends will increase the likelihood of the right products being grown.

27 http://time.com/4211871/chinese-food-history/

28 http://eatoffbeat.com/

Alternative plant-based proteins replicate daily diet

SHAPING MEGAFORCES

The global population is expected to grow to more than 9 billion people by 2050. With the population being wealthier than ever before, the growth in food demand will be particularly focused on animal proteins. In fact, some experts suggest that production of animal proteins will need to double to maintain sufficient supply.

This presents a number of challenges; including the availability of land, stock feed and water, as well as the environmental impacts of animals.

While there will always be a place for natural proteins, it is likely that the majority of the growth in demand for animal proteins will be satisfied through alternative forms. Cultured farming systems will provide part of the answer, as will textured plant proteins.

These products are not new; textured plant proteins have existed for decades. The likes of tofu and quorn are well known meat alternatives, and have been available in international markets for many years. Their potential has been constrained as they haven't sufficiently replicated the experience of mainstream foods and flavours that consumers are accustomed to.

Backed by major equity investors and with a sharp focus on innovation, organisations like **Impossible Foods,**[29] **Whitewave,**[30] **Beyond Meat**[31] and **Hampton Creek**[32] are developing alternative foods that closely replicate the experiences of meat, dairy and egg products. Made from plants, these products offer more sustainable, ethical, and healthy forms of proteins to consumers. The argument for these products is strong, given that:

– they remove the animal welfare issues that concern many people;
– they are better for the environment (reducing the contribution that animal based farming makes to climate change);
– they can be designed to include desired nutrients while excluding the attributes of natural food that contribute to health issues;
– they can be organic; and
– they can be manufactured in environments that make it easier to guarantee the products safety to consumers.

Danone,[33] a large French global dairy and nutrition company, is currently planning the purchase of **WhiteWave Foods**. The latter is a US business that specialises in plant-based milks and related products. The deal was sought as Danone has set a goal to 'help and support people in adopting healthier and more sustainable eating and drinking practices and constantly evolve their portfolio of brands and products to achieve this objective'.

Impossible Foods has engaged a team of scientists, farmers, and chefs that has spent years striving to develop the technology to naturally replicate a burger meat pattie. From taste to texture and sight, the burger is made from 100 percent natural ingredients – minus the cow – and has recently been launched commercially in major US markets.

Implications: We face a future where alternative plant-based products will no longer be reserved only for the dedicated vegan; but will provide healthy, sustainable, ethical affordable food experiences to the mainstream population.

29 http://www.impossiblefoods.com/
30 http://www.whitewave.com/investors/press-releases
31 http://beyondmeat.com/
32 https://www.hamptoncreek.com/
33 http://www.danone.com/en/

The miracle berry Synsepalum which is found in West Africa

Exploring the potential of natives

SHAPING MEGAFORCES

New wellness models

Fusion revolution

Facing resource scarcity

Social enterprise

It is estimated that we lack detailed knowledge of 70 percent of the flora and fauna species native to New Zealand, yet alone understand their nutritional and pharmacological potential inherent in these species.

The statistics for the number of species in Amazon rainforest are unknown, but the biological potential sitting in this region is considered to be almost infinite. It is estimated that only between 5 percent and 15 percent of the region's plant species which have the potential to become therapeutic drugs have been screened for bioactive compounds.[34]

It is worth noting that over 7,000 medical compounds are already prescribed by Western doctors that are derived from plants.

The undiscovered natural possibilities that exist in the world today will transform how we eat and administer medical care in the future. Yet the speed at which natural ecosystems are being destroyed in the name of development increases the risk that truly game-changing food and medicinal products will be lost before they are identified and their potential recognised. It is critical that we enter a new period of biological exploration to identify the solutions inherent in the natural environment that have yet to be discovered, cultivated and commercialised.

There are many examples of unique products that have already been discovered in our natural environment in recent years. These include;

– the miracle berry **Synsepalum** which is found in West Africa. The berry suppresses sourness to draw out a sweet flavour if it is eaten before food (imagine its potential to remove sugar from food while still delivering a sweet taste to the palate); and

– the **Korolex**[35] range of products developed from the horopito herb, native to New Zealand, which the company has commercially cultivated successfully for the first time. The herb has anti-fungal properties and is used to make products that are effective in managing long-term Candida.

The natural environment not only has pharmacological potential, but also the opportunity for plants to aid research. Certain plant compounds enable scientists to understand how cancer cells grow, while others can serve as testing agents for potentially harmful food and drug products.

Of course, some natural products have been illegally cultivated for centuries as illicit narcotics. However the recognition of the spectrum of uses available for some of these products is driving change in regulatory environments and creating new, legal opportunities for growers. The decriminalisation of marijuana in some countries and, more particularly, the rapid growth in its acceptance as a form of medicinal pain management has made the sector one of the fastest-growing primary sectors in some parts of the world in recent years.

Another emerging trend is the role of floral flavours in enhancing the experience that food delivers. Flowers are increasingly being used as a flavour component in unconventional foods and drink products.[36]

Implications: The natural environment offers almost unlimited potential to identify new sources of nutrition, healthcare and scientific resource; however we run the risk of missing this potential by underinvesting in building our knowledge in this critically important sector.

34 http://latinamericanscience.org/2013/11/why-its-worth-saving-the-amazon-rainforest-a-market-based-solution/

35 http://www.kolorex.com/

36 http://www.foodnavigator.com/Market-Trends/Flavour-in-focus-Natural-and-sophisticated-florals-on-trend-in-Europe/(page)/1

Other emerging themes...

Ancient and heritage foods revived as monocultures are increasingly challenged.

The global food system has scaled production by reducing the number of varieties produced in favour of high-yielding and uniform production. As a result, the majority of the global food supply comes from only 12 plant and five animal species.[37] Some 75 percent of genetic plant diversity has been lost since 1900, as farmers worldwide have transitioned from local varieties towards these high-yielding cultivars. This quest towards monocultures has raised concerns around the quality of nutrition, biosecurity exposures, and lack of choice for the consumer. These concerns will see a demand shift towards premium, more storied foods. Ancient grains and seeds like chia, millet, flax and quinoa are being integrated into all aspects of our diet. Demand will grow for the superior flavours and denser nutrition of heirloom and heritage fruit and vegetables, as greater value is placed in the diversity in our diets.

Insect proteins become a part of the daily diet.

Arguments surrounding the role insects will play in the global food system into the future have been rehearsed many times over the last couple of years. They are highly efficient protein converters; taking waste biomass and efficiently turning it into consumable, high-protein foods for humans and animals with limited effluent and (to date) no concerns surrounding animal welfare. They are also a regular part of the diet for billions of people around the world (from snails in France, to grilled crickets and grasshoppers in Asia). The beauty of insects is that we have yet to have any clear idea on the number of species that currently exist, and what their protein potential could be. This means we have probably yet to uncover the real game-changers. Recent research into cockroach milk indicates the mind-blowing scope of the opportunities inherent in the insect kingdom. Despite the cringe factor, it will not be too long before eating insects becomes mainstream. They will become an ingredient in the same way as whey protein concentrate or palm oil (and the reality is that we will be eating insects without even realising we are doing so).

There may be a role for scavenged food in the diet of the future.

In the natural food chain, larger animals prey on smaller animals until a primary predator that has no natural threats is reached at the top of the chain. When these animals die, they are eaten by scavengers that survive on the scraps they can find in the environment. The developed human food system has cut across natural food chains by growing food specifically for consumption; however as demand exceeds supply, it will be necessary to consider any source of protein. One argument occasionally raised is whether there is a role for scavenged foods in future of human nutrition. This may include commercially collecting and processing feral animals (such as goats or horses), linking pest eradication programmes to the food supply, and even collecting road-kill as a source of cheaper base protein for consumers. While none of these 'wild' food sources are highly palatable given traditional expectations around food, management of pest species could directly benefit the environment and boost the supply of natural animal protein in a world that is seeking more food.

Artisan, storied foods will always preserve a high value niche in global markets.

More and more of our food is now being sourced in non-traditional ways (such as cultured foods, insects, plant based proteins, wild foods etc). Given this, will traditional farmers still have a place in the global food system? The answer is yes, but that place will only be preserved for those farmers who produce authentic natural protein from a farming system that is excellent in all respects. Artisan, storied foods will come from farmers that focus on: restoring the biodiversity in their farming system, valuing every last drop of water, reducing their carbon footprint, treating their staff with respect, and contributing substantively to their communities. These 'model farmers' will produce food they are proud and passionate about providing to the world.

37 http://www.fao.org/docrep/007/y5609e/y5609e02.htm

Processing innovation

Instant access to information is creating the most informed consumer base in history.

Their purchasing decisions are driven by information; technical material on product functionality and authenticity provided by the product manufacturer, reviews written by other users and general social media commentary on the product and its competitors. The emergence of highly informed consumers will continue to drive innovation in how food, fibre and timber products are processed, to ensure that products meet their expectations and fit within their lifestyles.

Processors are facing many challenges. Consumers that want products with high end functionality at discount price points. Other consumers that are looking for unique and highly curated experiences that are highly tailored to their personal needs. While others are more focused on their environmental footprint and will seek products that have been created through value chains designed to maximise sustainability. A group of consumers are more interested in the story and branding that underlines a product because of the status and prestige using the product conveys on them.

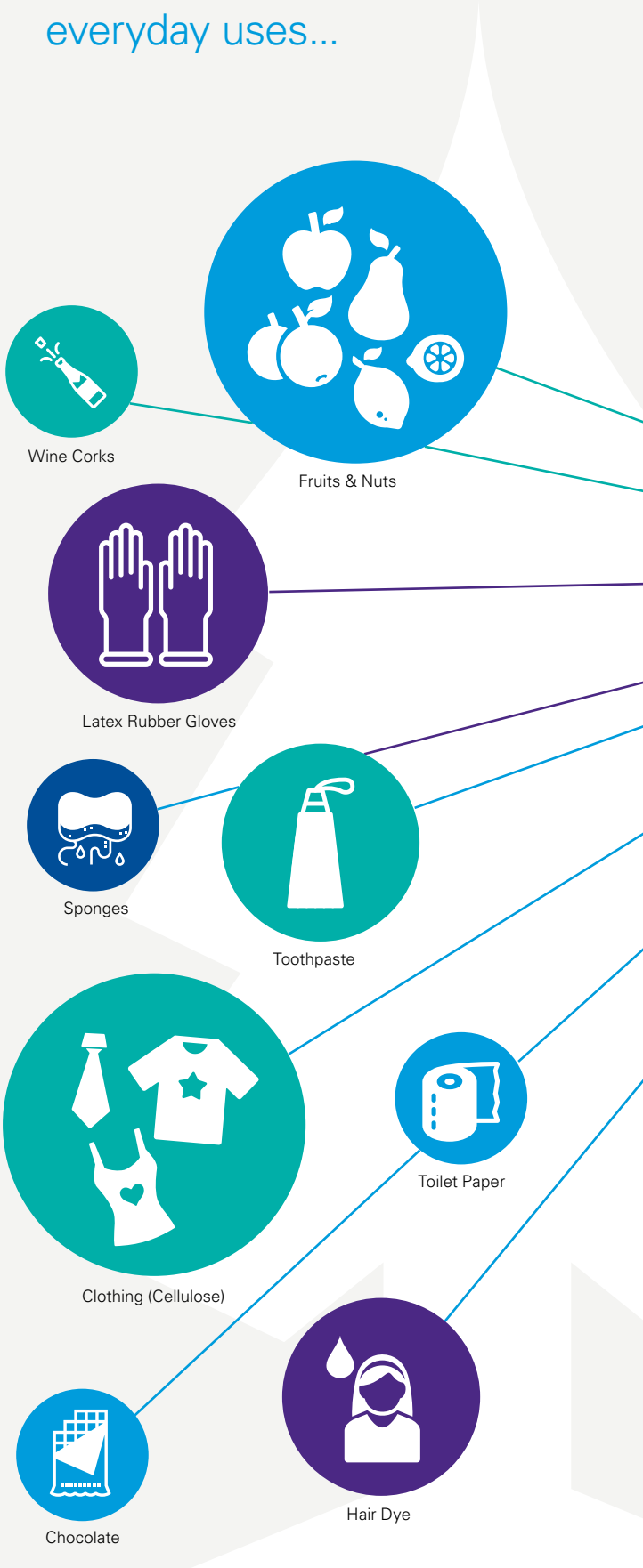
It is critical that processors understand the consumers their products are intended for; this enables them to incorporate features that consumers will value and pay a premium for, while excluding features that delivers no value.

Design capability driven by consumer insight needs to become a core competency for every entity. Consumers will quickly adopt products that solve their day-to-day challenges while ignoring products that are unable to deliver on their expectations.

This trend will be pronounced when attributes are personal to consumers. For instance the design of a product will be critical when it comes to attracting customers looking to source tailored nutrition that assists them in managing complex or chronic health issues. Thinking about how a product targeted at a person that may have arthritis in their wrists is packaged, to make access as simple and pain free as possible, is critical to creating a consumption experience that will attract repeat purchases.

We expect that how a product is processed will become as important to its overall story as the way it is grown and distributed.

Trees provide us with more than 5,000 everyday uses...




Inks
Oxygen
Rubber
Adhesives
Insulation
Houses
Waxes
Golf Balls
Medicines
Pine Oil
Chewing Gum

Tailored, genetically guided nutrition

SHAPING MEGAFORCES

- Government 3.0
- 21st-century consumer
- New wellness models
- Fusion revolution

Nutritional experts have long been intrigued by the fact a diet that works for one person, fails another. As a consequence, there is increasing focus on how genomes effect an individual person's mental and physical health and fitness.

Food plays a significant part in shaping who we are as people and how we function, yet within a geographic region we all largely eat the same types of food with little or no reference to the physical differences that exist between us.

With the challenges of fast paced modern life, it is becoming increasingly difficult to eat in a nutritionally balanced manner. As a consequence, many consumers are looking to functional foods to fill the dietary gap in their diets. More consumers are becoming health conscious eaters and looking to the foods they select to reduce the risks that their lifestyle choices give rise to.

Functional foods and beverages incorporate nutrients with specifically identified health benefits. The category also includes dietary or nutraceutical supplements and other personal care products with specific health benefits. The products, which are sold as ready to consume foods, products that can be reconstituted and supplements, represent a rapidly growing segment of the global nutrition market. Recent market research suggests that the nutraceuticals market is expected to grow at a compound rate of 7.3 percent over the next 5 years to achieve annual sales exceeding US$279 billion.[38]

Soylent, the world's most nutritionally balanced food[39] (discussed earlier in the report), and an another product, **Huel**, that has been designed to deliver all the protein, carbohydrate, fat and 26 vitamins and minerals[40] that the body needs to avoid being deficient in all essential nutrients, demonstrate that it is likely to be theoretically possible to live only on nutraceutical products.

With the global rise in chronic illness (diabetes, obesity, allergies and cardiovascular disease) traditional dietary guidance is being constantly reviewed. There is a growing focus on developing diet guidelines that consider the genetic makeup of an individual and the impact of their environment and lifestyle on health.

This trend is emerging rapidly in pet food category; you can now purchase highly tailored food for your dog addressing myriad factors from genetic make-up, to health issues the canine may have. **Just Right by Purina**[41] allows a consumer to create a profile for their dog, entering unique details, and Purina will recommend and supply a personalised dietary plan to help the dog achieve its health goals.

While personalised, tailored food has yet to gain the same traction in human diets, it is only a matter of time until similar technology interfaces are developed and solutions offered to human consumers. Currently, there are nutritional supplements available that have been designed to meet the needs of a demographic group. As food becomes a major tool to manage chronic health issues, we expect to see human supplements following those for our pets and becoming far more tailored to the needs of an individual.

Implications: As more consumers use food to manage and sustain their health, nutraceuticals are becoming an ever more important segment of the global food system, with an expectation that products will become more tailored to the individual.

38 https://globenewswire.com/news-release/2016/05/18/841073/0/en/Global-Nutraceuticals-Market-Research-Review-2015-2016-Outlook-to-2021-TMR.html

39 https://www.soylent.com/

40 https://huel.com/

41 https://www.justrightpetfood.com/

Replicating the sensory perceptions of food via a printer

SHAPING MEGAFORCES

Integrated urban living

Fusion revolution

Realising value in data

Facing resource scarcity

One of the biggest disruptions to the global food sector will come from the ability to print food that not only looks like the food we know and trust but has similar sensory perceptions – the smell, crunch, chew, texture and consistency that makes us love the foods we love.

Food printing will change the food vending sector forever. The afternoon office snack will be unleashed by the potential of food printing. The vending machine could perform a non-evasive scan of your current state of health to identify the nutrients you need now to get you through to your next meal. It could then print off your tailored afternoon snack that looks and tastes like your favourite chocolate bar or piece of fruit, but in reality is a perfectly nutritionally balanced snack that will see you through to dinner without wasted calories and with all the nutrients needed.

The combination of innovative ingredients able to be used as printing materials, software and printing technology is opening up a world of possibilities in the form of digital food printing.

An example of the potential inherent in food printing was demonstrated by Food Ink, a pop-restaurant that opened over the summer in London. Food Ink created a one-of-a-kind experience in the form of a restaurant, were all the food, all the utensils and all the furniture were produced through 3D-printing, creating an immersive futuristic space. The restaurant was described as place where fine cuisine met art, philosophy and tomorrow's technologies, leading the way in being able to replicate sensory perceptions of food.[42]

Food printing is currently a novel technology but many novel applications are already appearing for the technology. The development of 4D technologies offers the potential to create deeper experiences; products that more accurately represent all the sensory experiences that we seek in food or that have dynamic capabilities, such as the ability to self-transform over time. It is likely that we will ultimately be able to print food that is alive. For instance printing products that mature in the same way that a natural product does or that incorporates live cultures, such as probiotics.

Printing technologies also offer the potential to produce food that responds to some of the challenges we face with natural food products. Products can be printed in such a way that only the elements of a product that we want to eat are printed, for instance it may become possible to print an 'apple' without a core, helping consumers solve the problem of what to do with the core when they have finished.

It will also become possible to print food that has a large environmental footprint; one of the early uses of the technology has been printing 'beef' steaks that enable people to enjoy a steak without the concern over the impact its growth has on the environment.

Implications: Food printing offers the potential to deliver highly tailored food that will replicate the natural experiences consumers are seeking while addressing the inherent issues that exist with growing and using these foods.

42 http://foodink.io/

Extracting full value from molecular structures of the products we grow

SHAPING MEGAFORCES

We are increasingly recognising not only the obvious potential in the products that are grown but the inherent potential in their constituent parts.

Extracting all the available value from production is not a new trend, it has been a goal for most primary sector businesses for decades. In the future producers and processors will not just be looking for the obvious value in co-products (for instance the opportunities to create new markets and grow incremental value from offal, blood, bones and skins in a meat processing business) but the hidden value that can be extracted from exploring the molecular structures of a product.

As a consequence more research effort is being directed towards the molecular properties of plants and animals. A good example of the number of uses of a commercially grown product is the range of applications that can be extracted from the forested radiata pine tree. The tree, which is often used for framing buildings with waste biomass being turned into paper pulp, presents researchers with a raw material to work with that can be turned into a spectrum of high value products.

New Zealand Crown Research Institute, **Scion**, is conducting a wide range of research into alternative uses for forested timber[43]. The research at Scion has not only sought ways that timber can be used in construction for more than just framing, developing load bearing structural timber products that can be used in large commercial buildings, developing innovative bio-adhesives and new bio-plastics from forest biomass as well as looking at ways waste biomass can be used as an environmentally friendly fuel source. The work conducted by Scion highlights the significant hidden value within a day to day product, such as timber, as our understanding of its molecular structure increases.

Innovation however goes well beyond timber; work is progressing on the proteins that exist in wool and what their potential uses maybe. Other researchers are looking at how they can produce sustainable food wrappings from the waste streams coming out of the food production. A further example is **Brewtroleum**, an initiative by Gull Fuels and DB Breweries in New Zealand, which saw waste streams from beer production being used to produce a commercially distributed biofuel.

Chefs around the world are creating gastronomic experiences by breaking down food into its constituent parts, creating entirely new molecular ways for consumers to enjoy food. Molecular gastronomy has been pioneered by high profile chefs like Heston Blumenthal, who has developed a scientific approach to cuisine that he refers to as multi-sensory cooking.

Other chefs are taking up the challenge of creating new ways to experience food, one example being **Café Art Science** in Cambridge, Massachusetts. The business is run by academics from Harvard University, is described as a café for the sensorium... where culinary art, science and design meet the sustainable future of food.[44]

Implications: Research is unlocking the financial opportunities inherent in the molecular structures of plants and animals we grow by creating sustainable products and new consumer experiences.

43 http://www.scionresearch.com/
44 http://www.cafeartscience.com/

Other emerging themes...

Ultra-raw foods can generate significant price premiums.

The value of a product is sometimes maximised by doing absolutely nothing to it other than moving it from where it is caught or harvested to where it will be consumed. Fresh fish caught alive is probably the best example of the potential inherent in ultra-raw foods; its value is multiplied many times over if it can be delivered alive from the ocean to a tank in a restaurant in Asia enabling it to be sold alive and cooked to order. While it may sound simple, doing nothing to a product other than transporting it in peak condition to a market that could be thousands of kilometres away, is often very challenging. It requires complex supply chain solutions to get food products in their raw form to their consumers in condition to attract the price premiums necessary to underwrite the cost. The price premiums for ultra-raw products reflect growing consumer concern increases about the impact that processing has on many of the beneficial enzymes and the nutrients in the raw food.

The high protein revolution accelerates.

Protein used to be a word exclusively reserved for scientists and nutritionists, however it is as likely to pop up today in a challenge on **Masterchef** as it is in a scientific journal. As consumer awareness of the constituents of good nutrition build, the central role of protein in our diet is more understood and consumers are paying premiums for healthy, innovative, high protein foods. A glass of milk is no longer a glass of milk but a protein beverage, and it's value grows as the amount of protein it delivers increases – so much so dairy companies are refocusing their business towards high health opportunities, like sports nutrition. The role that protein rich diets plays in maintaining general health and well-being is attracting a new wave of health conscious consumers, particularly amongst millennials, who are prepared to pay a premium for innovative high protein foods.

There will always be a place for something just a little bit naughty.

In world where more consumers are becoming health conscious and eating for identified health benefits of food, their undoubtedly remains a place in the diet of the vast majority of consumers for the treat food experience. Whether this is an extravagant meal out, a take away of choice or a favourite dessert, consumers will continue to crave these treats every now and then. The treat maybe smaller and consumed less frequently, but consumers will be seeking better quality products and bigger experiences, to ensure that they get the best return from their financial and dietary investment in the treat. **Lewis Road Creamery**[45] have demonstrated that when you do provide differentiated treat experiences, and back it with a well-planned marketing strategy, it is more than possible to get consumers in the best suburbs out of their yoga studios and into the supermarket aisles to fight over a highly priced treat.

Returning craft to mainstream consumers.

A trend currently driving growth in the beer sector provides an indication of the desire consumers have to seek out storied products. The proliferation in the number of craft brewers globally, offering regionally, distinct handmade products is driving growth in the beer segment in many countries, as brewers look to create differentiated products that provide a journey of exploration for connoisseurs. The craft beer sector in the US reported its eight consecutive year of double digit growth in 2015; the sector's volume growth of 13 percent compared with a decrease in the total volume of beer sold over the same period of 0.2 percent.[46] We expect the craft trend to spread; craft cider will take off globally but also in further processed categories like confectionery, cheeses, ice creams, sorbets as well as ready to eat processed meals are all expected to enjoy a craft benefit. An uncertain world encourages consumers to hark back to the food and drink that their grandparents used to enjoy, with craft offerings being well positioned to satiate these desires.

45 http://www.lewisroadcreamery.co.nz/

46 http://fortune.com/2016/03/22/craft-beer-sales-rise-2015/

Changes in how food is distributed

There is much discussion in this report about disruptive technologies and the impact that they will have on how we grow, process, distribute and experience food in the future.

When it comes to distribution, the primary tool that will drive disruption has been with us for almost a decade. We are only now recognising its potential to totally transform how we live our day to day lives.

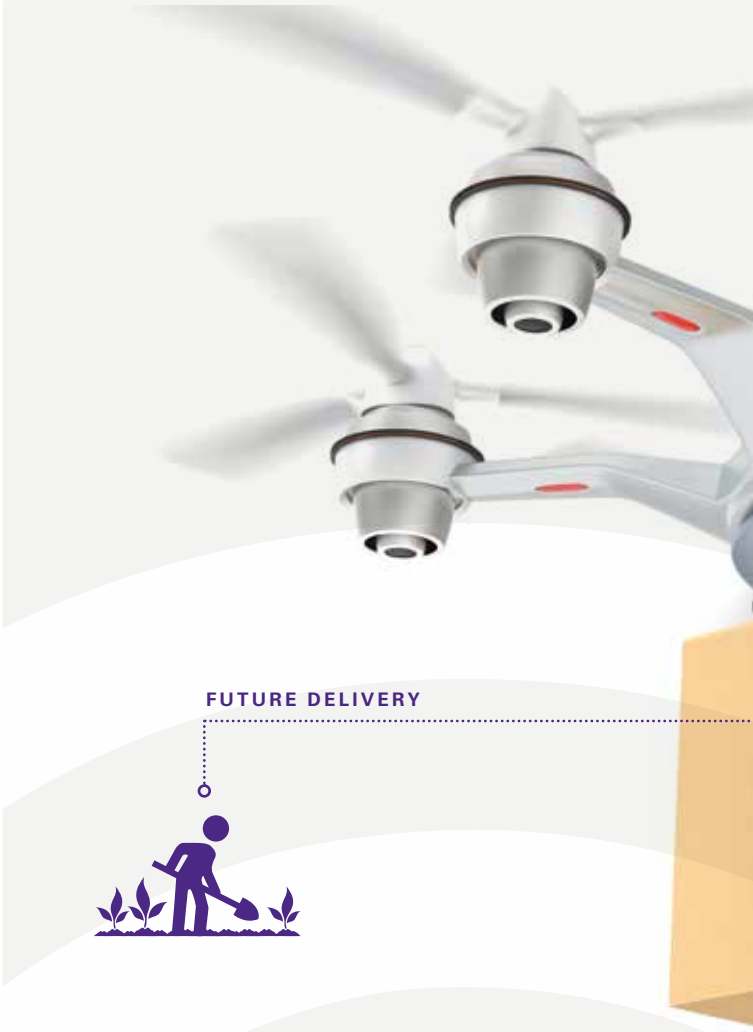
The technology is the smart mobile device that billions of us now carry around. It offers the ability to create completely new distribution models for food products that can connect a consumer more directly to the producer and, as a consequence, shift where margin is captured along the value chain.

The idea of the weekly shop being completed under one roof has shaped the evolution of modern retail channels over the last 50 years or so. Yet the reality is most people around the world do not buy food from a supermarket, they still use traditional markets, family and friends to source the food they need. This creates opportunities for disruptive food retail business models to crystallise in emerging economies, where the incumbent strength of the major food retailers will not be trying to slow the shift away from the bricks and mortar stores that they have invested billions of dollars into.

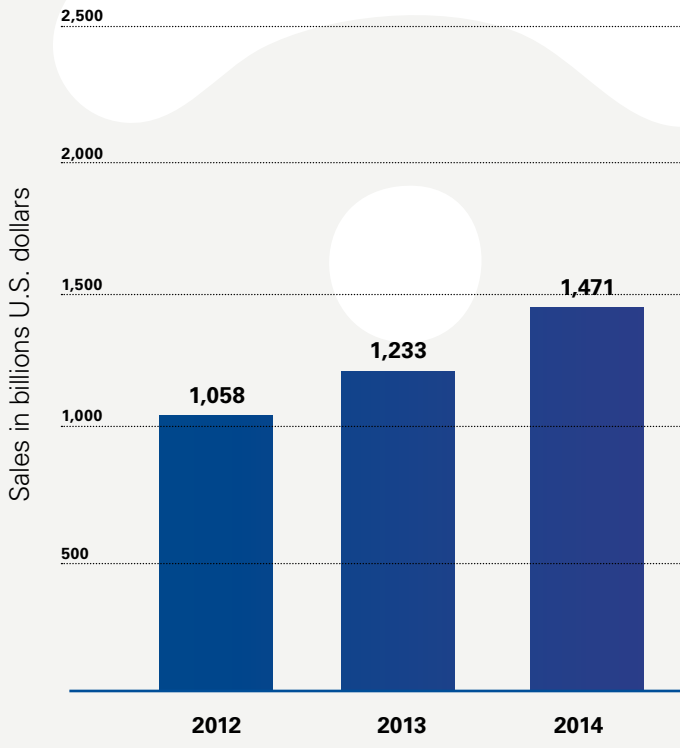
Models will develop that disaggregate the western shopping experience, taking it back to the future in many ways. The models will reflect the time pressures consumers are under, a desire to select from products that have important attributes (be that price, nutrition, provenance, origin, reviews or any other criteria) and a wish to make life a bit easier.

We foresee a situation where the weekly shop is replaced by a series of apps that connect a consumer to their greengrocer, butcher, fishmonger, baker, delicatessen, wine merchant and pharmacist to complete on demand sourcing.

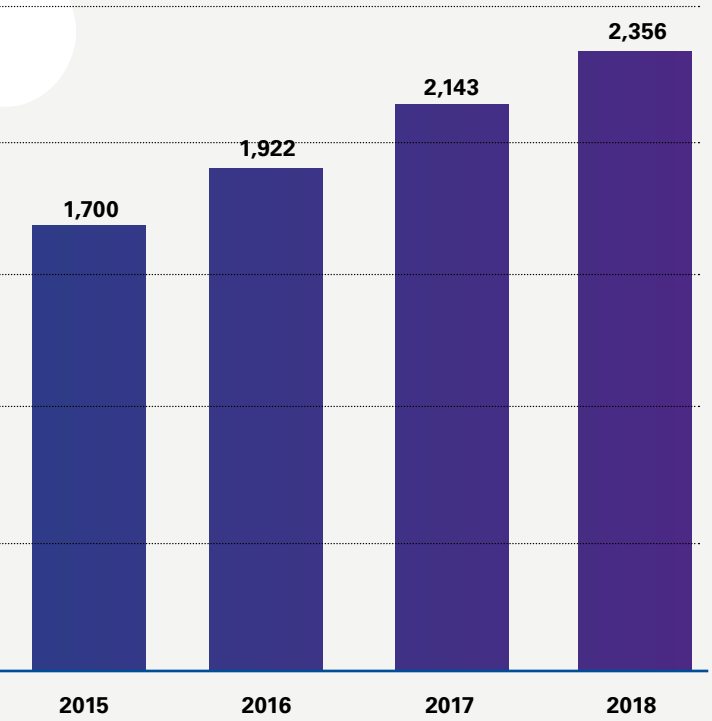
The challenge for retailers is how they remain relevant in a world of unlimited choice online and delivery moves closer to instantaneous. How do they deliver a curated experience to consumers that will keep them coming into stores to maintain a viable business? The battle ground in food distribution over the next decade is for the control of the customer relationship; it is the step on the value chain that unlocks the greatest share of the value within a product to the owner of that relationship.

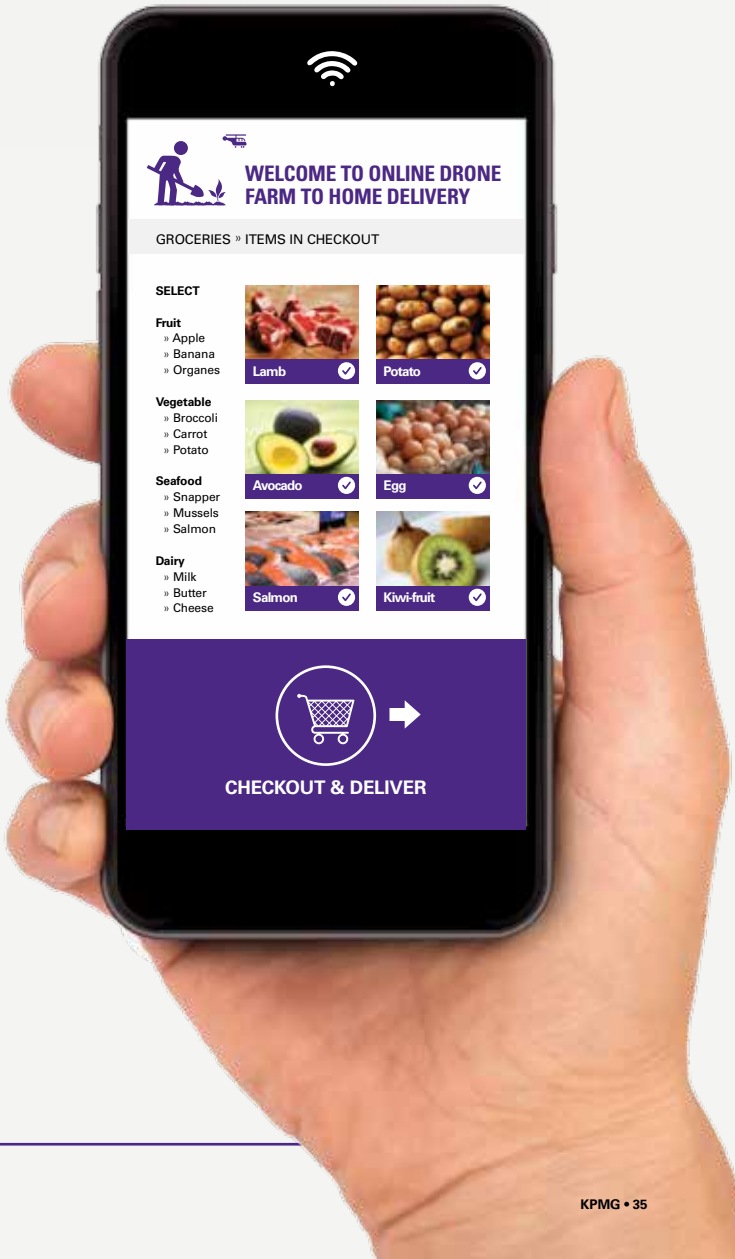


US Dollars spent each year via online shopping[47]



47 https://www.statista.com/statistics/261245/b2c-e-commerce-sales-worldwide/


1,700
1,922
2,143
2,356
2015
2016
2017
2018


WELCOME TO ONLINE DRONE FARM TO HOME DELIVERY
GROCERIES » ITEMS IN CHECKOUT
SELECT
Fruit
» Apple
» Banana
» Organes
Vegetable
» Broccoli
» Carrot
» Potato
Seafood
» Snapper
» Mussels
» Salmon
Dairy
» Milk
» Butter
» Cheese
Lamb
Potato
Avocado
Egg
Salmon
Kiwi-fruit
CHECKOUT & DELIVER

Local food is all about provenance

SHAPING MEGAFORCES

Geopolitical instabilities

Government 3.0

21st-century consumer

Climate changing

The local food movement has become a notable component of the premium food sector that has emerged globally in recent years.

Consumers have flocked to farmers markets and bought local in their stores as they have sought to understand who is growing their food, to build relationships with them and to connect with the story behind the food they purchase. The ability to make an assessment of the integrity of the person that has grown your food and the alignment of their ethics with yours has seen the local food movement become defined by geographical proximity. If something is grown more than 50 miles away many consumers would not consider it to be local food.

The more we have explored the concept of local food, it has become apparent that being able to understand the authenticity and provenance of the food and who has produced it is far more important than being geographically close to its source for many local food consumers.

As a consequence, technology will enable any farmer, anywhere in the world, to become a local food supplier to consumers across the planet. The Internet becomes their virtual farmers market; they can use video (and in the near future virtual reality) to tell their story and provide evidence to support product authenticity, use social media to have real time conversations with consumers and use an e-commerce platform to supply food on a timely basis.

Research suggests around 50 percent of consumers are willing to pay up to 10 percent more for locally grown or produced foods, and almost one in three are willing to pay up to 25 percent more.[48]

Verifiable provenance is a bottom line for storied food

Any producer wanting to be a local farmer to the world must be able to verify the safety of the products they produce. The emergence of social media means a contamination incident can go viral within minutes. This is challenging as stewardship responsibilities increasingly encompass the whole time that your brand is associated with the product, even if that extends beyond when you control the product. The reputational and financial implications of a failure can be catastrophic to a business.

As supply chains extend and become more complex, the risks associated with food fraud and corruption are on the increase, further reducing the trust consumers have in the product in the package being the product described on the package. There are solutions being developed that apply digital and chemical technologies to verify the safety and integrity of products, by they food, fibre or timber. These technologies include digital printing solutions that print a unique, traceable label for each unit produced and chemical foot printing of a product so it is possible to categorically state whether the content has been tampered with. As these technologies become more accessible and cheaper, their use will increase, bridging the gap of trust with consumers.

Implications: Any producer can become a local producer to the world if they can build connections with consumers and authenticate product provenance, providing an opportunity to secure price premiums.

48 http://fortune.com/2015/08/21/local-food-movement-business/

Digitally enabled direct to consumer channels reshape food retail

SHAPING MEGAFORCES


Government 3.0


21st-century consumer


Fusion revolution


Realising value in data

Many food retailers appear to be on a journey to irrelevance as their focus on low pricing impacts the experience that they deliver to consumers. The most innovative food producers are seeking alternative channels to market. Premium consumers wanting choice seek out niche retailers or explore opportunities to source food directly from the producer through online channels.

Without reinvention, it is unlikely the supermarket experience that dominates modern retail around the world will survive. Conventional supermarkets need to find ways to stay relevant.

Entirely new business models have emerged in recent years (like Uber and Airbnb) demonstrating consumers, particularly millennials, place greater value on instantaneous access to products and services than in the past. Access rather than ownership allows greater lifestyle flexibility. The access principle will shape food retail; the idea of buying a week's groceries at one time will become redundant as consumers demand fresh produce and want it delivered now in the format that they wish to use the product. Access models mean fresher food, enhanced nutrition, less wastage, more flexible lifestyles – wins for the community and the consumer.

Digital distribution models for food represent one of the most significant areas of new investment into the agri-food sector. The initial models were online versions of the supermarket experience with fulfilment being completed via delivery or click and collect models. Specialist online retailers have entered the food market; **Amazon Fresh,**[49] offers consumers a fresh food selection which can be delivered within an hour for subscribers to the prime service.

Other organisations are offering richer experiences to the consumer. Businesses like **Blue Apron**[50] and **My Food Bag**[50] that provide the ingredients and recipes for consumers to cook their own meals at home have emerged around the world. The challenge to these businesses is that they have to place rules around ordering for their logistics to work, which reduces how flexible the service is for a consumer.

Platforms have also been created that directly connect the consumer to producer, often with a specific product category focus, such as organics. Examples include **Aussie Farmers Direct**,[52] which provides farm fresh food to a consumer's front door, and **Oooby**,[53] a service that specialises in delivering local and organic food.

Ultimately, consumers will disaggregate their weekly shop, buying from the best butcher, dairy, greengrocer, fishmonger, baker, vintner, pharmacist, general merchant and will make their purchases using their smart device. The future of food retail is effectively back to the future with the addition of to-the-door-delivery.

Virtual reality technologies present an opportunity to take consumer connection to the next level. They can place a potential consumer into a farming system, immerse them in the value chain, create interactions with the people producing the product (and provide samples if connected with a food printer). VR has the potential to take engagement to a level well beyond the farmers market or the supermarket for those producers looking to develop deeper relationships directly with their consumers.

Implications: Food retail models are evolving as consumers seek access to innovative, new products and services through a channel that fits best withing their lifestyle.

49 https://www.amazon.com/b?node=10329849011
50 https://www.blueapron.com/
51 https://www.myfoodbag.co.nz/
52 https://www.aussiefarmers.com.au/
53 https://www.ooooby.org/

Made from mushroom pulp

Supply chain innovation increase food availability

SHAPING MEGAFORCES

- Geopolitical instabilities
- Government 3.0
- New wellness models
- Social enterprise

A key to eliminating under-nutrition globally lies in transforming the supply chains that move food from the producer to the consumer. The estimates surrounding the amount of food wasted globally are well known; much of the approximately 40 percent of food that is never eaten is lost through spoilage in the supply chain.

A large percentage of this spoilage occurs in emerging markets as food handling, packaging, storage and transport standards allow for products to become damaged or contaminated.

Ensuring the food grown around the world actually reaches the intended consumer in an edible state is critical to growing the volume of food available globally. This is driving deep innovation in global supply chains. This could be as simple as changing the handling, packaging and storage techniques for grains, fruit and vegetables to minimise the risk of the product spoiling.

Simple solutions can deliver remarkable results. Changing the type of sack farmers use to transport their rice and grain, to ones which work effectively in the ambient conditions and can be sealed, as well as raising the store off the ground helps keep vermin out of a product, it reduces the risk of contamination.

Supply chain technologies widely adopted in developed markets, to reduce the amount of food that spoils in transit, need to be evolved to enable them to bring benefits to the remote regions of the planet. We expect to see social enterprises introducing not just innovative packaging solutions but looking at cost effective refrigeration solutions, upskilling communities in the safe handling and grading of food (so that high quality products are not packed with rotten ones) and the development of cultivars that are better able to handle transit in challenging conditions.

It should not be overlooked that part of the solution will also come from investment into physical infrastructure (particular roads in the remote regions of the world, opening up more efficient and fast routes to market) and reengineering of global logistics (air freight may become more viable for fresh product with large premiums, something we are currently observing with the transport of fresh liquid milk into high value markets like China).

Packaging Innovation will be part of the solution

As the desire to create sustainable, eco-friendly products increases, the way we package consumer goods is also being re-engineered. For many consumers plastic is no longer acceptable. Companies such as New York's **Ecovative** are using biomaterials to create high performing, premium products that are safe, healthy and certified sustainable. They work alongside industry and consumers to eliminate toxic, unsustainable materials without having to sacrifice on cost or performance.[54] An example of their product is Myco packaging made from mushrooms. **IKEA** announced earlier this year they are planning to swap their packaging to this material, as part of a wider sustainability strategy.[55]

Implications: Supply chain innovation will play a material part in delivering a more sustainable agri-food system better positioned to meet the growing demands of consumers

54 http://www.ecovativedesign.com/

55 http://www.telegraph.co.uk/news/earth/businessandecology/recycling/12172439/Ikea-plans-mushroom-based-packaging-as-eco-friendly-replacement-for-polystyrene.html

Other emerging themes...

Reinvention of traditional supermarket experiences to make them relevant to the consumer.

Major global supermarket chains are not taking the threat of digital disruption lying down. Initial strategies have included the development of multi-channel business models (shift stores on line and into mobile formats), introducing delivery and click and collect services, loyalty programmes tied to powerful analytic tools and redesigning the in store experience and range to make it a more attractive to premium consumers. Some retailers have followed the Whole Food Stores model and created food Disneyland's for adults, providing wide choice and details on product provenance.

Others have diversified their range into new categories, introduced organics or developed sustainable sourcing models with their farmers. Physical stores may progressively become showrooms, more about experiencing new things than actually buying the groceries (similar to what is happening in fashion apparel), the only thing being certain is that they, like everybody else, will need to change to survive. In recent examples, **Amazon** has formed a partnership with e-commerce firm Fresh Nation to deliver fresh produce from farmers' markets to homes. In Australia, **David Jones** is reinventing some of its stores to specifically target the ready to eat food market.

Austerity accelerates collaborative, co-operative buying projects.

The period since the Global Financial Crisis has been the longest period of economic austerity experienced by the developed world since the Great Depression of the 1930's. Financial pressures have forced many people to change their diets, simplifying the food they eat in favour of cheaper forms of protein, while still trying to ensure that healthy, safe food is put on their family's table each and every day.

To counter these pressures, groups of consumers have started to club together and form purchasing co-operatives. Consumers pool their volumes to provide them with sufficient scale to go and seek out farmers and food suppliers that they can enter into direct bulk buying deals, accessing fresh food while avoiding margins collected along the value chain and as a consequence securing better prices. In some ways buying co-operatives represent a step backwards to the co-op's of old, however there is a significant difference as these groups are often enabled by technology to attract members, facilitate ordering and aid fulfilment.

Changes in how we eat

Lifestyles are accelerating. Smart devices have made it almost impossible to escape the reality of the day to day grind; just think about the panic that sets in when we realise we have left our device at home. It illustrates how central this single piece of technology has become to our lives.

To cope with modern life we constantly seek out tools that enable us to manage the volumes of data we are expected to process on a daily basis (wearable technologies, artificial intelligence and computer learning tools, self-driving vehicles, personalised operating systems). Tools that can also help us ensure that we do not forget about the basic necessities of life; the food, sleep and human interactions we need to function optimally.

A good example of the challenges modern life presents is becoming apparent in rapidly growing cities around the world. The distance that individuals are having to travel to work on a daily basis is a major contributor to busier lifestyles many are people dealing with. With no option but to live further from their place of work, commute times grow for many meaning that traditional meal times, particularly breakfast, are being spent by hundreds of millions of people travelling, on the train, bus or in the car. This means that the way food is taken is evolving by necessity.

This is one example of why the way food is designed and packaged will need to evolve to fit more effectively into a commuter's daily life than it has ever done before. In a time poor world stopping for a meal is becoming a luxury few can afford, an ever increasing percentage of the food consumed will be taken on the go.

However, when we do stop for food it will be an event to be shared with family, friends or colleagues and, as a consequence, it will take on greater importance. It will be one of the few times we have face to face social interactions, thus we will expect more experience and innovation in our food.

Faster lives are also putting greater pressure on our bodies, placing them under more stress, providing less time for exercise, recovery and sleep and, as consequence, contributing to a wide range of emerging modern health conditions. In a world where the cost of curative healthcare systems are spiralling rapidly out of control, we expect that food will become an integral part of healthcare regimes designed to prevent certain diseases occurring, while also becoming a key tool used in managing the effects of existing health issues and the stresses associated with modern life.

795 million
people in the world do not have enough food[56]

12.9%
of the population is undernourished

3.1 million
children die a year from poor nutrition

The world now has more

overweight and obese people than underweight

Obesity has doubled

since 1980

1.9 billion overweight people

600 million of these being obese (in 2014)

87%

of deaths in high income countries are due to chronic disease vs. 43% in low income.

48%

of deaths in low income countries due to nutritional deficiencies vs. 7% in high income.

(Graphic above) 56 http://www.fao.org/statistics/en/

Eating to manage health becomes enshrined into society

SHAPING MEGAFORCES

- Government 3.0
- The ageing generation
- New wellness models
- Targeted education

With the majority of baby boomers due to hit retirement age over the next 15 years, Governments around the world are bracing for further pressure to come onto already strained health care systems. By necessity the way our health care services are delivered will have to fundamentally change to avoid the systems breaking down entirely.

It is a financial reality for Governments around the world that the cost of the traditional curative model of healthcare systems they operate is rapidly becoming unsustainable. Advances in medical science enable us to keep people alive for longer. The ageing population is the largest user of these technologies, while their contribution to funding the services reduces as they reduce their economic contribution to society as they retire.

The most obvious model to be explored is the redirection of investment towards models designed to prevent people getting sick in the first place. Preventative healthcare models invest proactively in programmes to enable very early detection and treatment of illness, along with education around healthy living (including eating practices) to minimise the number of people that become ill, particularly as they age.

By 2043 it is estimated that in New Zealand over 70 percent of the population will be over 65. Currently, it is estimated that around 85 percent of people aged 60 and over are managing at least one chronic health condition.

A combination of Government programmes and personal lifestyle goals will result in more individuals seeking to gain any advantage available to prevent illness and maintain health. Many will increase the focus they place on food as a key tool for managing health outcomes. Ageing consumers, particularly in the developed world, have often spent much of their working lives providing for their retirement, thus they have the capacity to buy premium products that deliver the nutrition they are seeking together with a more tailored experience.

Many global food companies are investing heavily in nutrition strategies and products that have demonstrable health benefits. **Fonterra Co-operative Group**[57] are using Anlene, a dairy product with proven benefits for bone health, as a key driver of their growth in emerging consumer markets in Asia.

Nestle[58] have created a platform to educate people on healthy aging and the importance of nutrition and supplementation. They have developed a range of nutritional solutions to sit alongside the platform, which are tailored to older consumers, incorporating not just nutritional features but also packaging innovations such as bigger fonts and easy-to-open formats.

Considering the format of a product and the experience that it delivers will help to create value for ageing consumers; getting the texture, taste profile and packaging right is critical.

The reality that you are what you eat will increasingly shape what people eat, either by choice or, ultimately, as the result of regulation that defines what should be eaten and what should be avoided.

Implications: Agri-food companies will benefit from new market opportunities emerging as population's age, however investment will be needed to verify health benefits and deliver products in appropriately tailored formats.

57 https://www2.fonterra.com
58 http://www.nestle.com/

Quality of Life Index:
Slowest Commute Times (Avg)[59]

Rank	Country	Minutes
1st	Egypt	51.02
4th	Russia	48.41
8th	Brazil	47.17
11th	China	44.73
15th	South Africa	43.35
24th	Canada	37.25
55th	New Zealand	28.51
60th	Switzerland	27.37

Fitting food into modern urban lifestyles

SHAPING MEGAFORCES

- Economic rebalancing
- 21st-century consumer
- Integrated urban living
- New wellness models

Today's fast paced lifestyle, means that consumers are seeking solutions that enable them to minimise the time that they have to spend doing the routine things that need to be done, maximising the time available to do the things they value.

As urbanisation surges around the world the separation between home and work is growing. New lifestyle rules are evolving, changing how we eat and how food fits into our lives on a daily basis.

As average commute times extend in major cities to three to four hours a day, more meals are being taken in transit or eaten away from the home. There are significant opportunities for producers that are able to design products that are able to better fit into the day to day lives of their consumers; this could include reinventing the packaging formats to make the product easy to use, reconstituting products to meet the nutritional and practical needs of the commuter travelling over traditional mealtimes or introducing new and differentiated flavour options. Significant value is available to those that make it easier for commuters to fit food into their lifestyles.

It is not just the amount of time spent travelling which is reshaping how people engage with food. The costs of property in urban centres mean people are living in smaller spaces, often without full cooking facilities. This naturally means that people will spend less time planning and preparing meals looking instead for more convenient ways to access food.

For some convenience means ready to eat meals that can be put in the microwave (a good example being the extensive range of premium heat and eat products that **Marks & Spencer** in the UK provide, often through outlets located in key transport hubs), for other it is easy-to-prepare meals (the combine with boiling water and eat type products) while for some it is takeaway products.[60]

Other consumers are looking for on the go convenience, with a fresh, healthy edge. Companies such as **Jess's Under Ground Kitchen** in New Zealand offer consumers (who are often urban based, young professionals) a gourmet, freshly cooked meal that can be collected from a convenient point near their office and eaten on the go without missing out on nutritional benefits.[61]

Many millennials appear to be shying away from the fast food eating habits that their parents pioneered and actively seeking out food products and services that will aid in their wellbeing journey.

Ultimately, we think that millennial behaviours will shape the future of the food industry as their desire for healthy, affordable, tailored and flexible eating experiences drives innovation into new formats and products. A good example of this innovation are social food businesses like **Eat My Lunch.** A company that will prepare and provide a free lunch to a child in a socially deprived area when somebody orders their lunch from the company (a buy one, give one model).[62]

Implications: Our lifestyles are getting in the way of traditional dining practices; people want products that fit around their job to maximise the time available for them to do the things they want to do.

59 https://www.numbeo.com/quality-of-life/rankings_by_country.jsp
60 http://www.marksandspencer.com/
61 http://www.myundergroundkitchen.com/
62 http://www.eatmylunch.nz/

Kombucha – the superfood pro biotic beverage.

Fermenting food reshapes western diets

SHAPING MEGAFORCES

- 21st-century consumer
- The ageing generation
- New wellness models
- Fusion revolution

We often talk about a "gut feeling" or "trusting our gut instinct" and it turns out, research is suggesting that this mind-gut connection is not just metaphorical.

As the pace of life increases, many people are focused on maintaining body function at optimal performance levels to maximise their lifestyles. More consumers are taking the time to select food that is healthy, while some are looking for foods that are capable of preventing illnesses occurring.

Many nutritionists consider the effective operation of the gut to be so critical to maintaining effective health that they refer to the gut as the body's second brain. This increased awareness has in turn generated a wealth of research into the gut-brain connection.

There are an increasing number of claims being made by food producers around direct links between gut health and improved cognitive and brain health. Some also suggest that maintaining a healthy gut also decreases the risk of neurodegenerative and some autoimmune diseases. Expect to see continued headlines about eating food that protects, boosts, and supports your gut, as our understanding of how the body interacts with food and nutrition.

Fermented foods such as kimchi, sauerkraut, kombucha, kefir, yogurts and cultured cheeses are amongst those that have appeared in the market, many of which are being sold with claims about positive impacts on gut health. Fermentation found in food is the process of converting carbohydrates to alcohol or organic acids using microorganisms; they are believed to have impacts on altering the chemical balance of the body. The ability for these foods to rebalance brain chemistry or change mood will result in these foods becoming more widely adopted in western diets to counter stress and anxiety.

It is anticipated that by 2021, the **Kombucha**[63] market (a fermented, lightly effervescent green or black tea beverage) will reach US$2.1 billion alone, while traditionally ethnic foods, like kimchi and kefir, are now being sold in markets around the world, driven by consumer interest in their active properties.

Active foods – probiotics and algae to the fore

As people increase focus on the nutrient content of their food and what it delivers beyond taste, texture and experience, the demand for foods that have the capability to make a contribution to health long after they have been eaten will continue to grow.

Probiotics in dairy products, fermented foods, algae and sea plants, as well as the antibacterial properties of Manuka honey are creating high value markets targeted at those taking a holistic view of their health. We expect this sector will increasingly become the domain of pharmaceutical companies, businesses experienced in proving the health impacts of their products in a scientifically robust manner.

Implications: Consumers increasingly expect the food they consume to not only be healthy but capable of taking a role in enabling them to achieve lifestyle goals, creating opportunities for producers of active foods.

63 http://www.researchnester.com/reports/global-kombucha-market-analysis-opportunity-outlook-2021/66

Other emerging themes...

Foods role as social connector evolves in a digitally connected society.

While we have never been more connected, the reality is we increasingly spend less time physically face to face with family, friends and colleagues than in the past. The art of conversation is being replaced with text messages and emojis, screens dominate day to day life and traditional sit down family meals are ever harder to lock into schedules. When people do come together it is often around a meal giving food a key role in connecting people and maintaining social bonds. The food that is served takes on more importance; consumers will seek out food that aligns with their values and ethics, that illustrates their affluence and success and, most importantly, indicates how much they value their family, friends or guests. Producers that are able to build a story around their produce that supports the messaging a consumer is wishing to communicate will be able to capture a premium.

Restauranteurs offer new dining paradigms to the market.

Television has created global megastars of chefs like Jamie Oliver, Gordon Ramsey, Wolfgang Puck and many others. It has provided these chefs, who have previously plied their trade in small kitchens outside the limelight feeding small groups of very affluent consumers, vast name recognition and more importantly potentially millions of consumers looking to try their food due to their personal brand. As a consequence, many of them are diversifying their businesses away from purely delivering Michelin stared food to white table clothed dining rooms and are creating new concepts designed to deliver high quality yet affordable food to the mass market. A good example of this is Gordon Ramsey's Plane Food, an outlet at Heathrow that provides an affordable picnic option to travellers departing on flights, as well as an experience of Gordon Ramsey's food. At the same time, fast food operators that have traditionally operated in the affordable food segment are looking to increase their average ticket value, using technology to enable consumers to design their own burger at the point of sale or through introducing gourmet ingredients and menu extensions.

There will be more passionate foodies in the future prepared to explore innovative food and beverage.

In addition to creating a plethora of celebrity chefs, food television has raised the understanding of the diversity of tastes, flavours and textures available across the world. It has created the first true generation of global foodies, people that are passionate about eating interesting, storied food and are prepared to explore and experiment to find new and unique food and beverage sectors. Sectors like wine, craft beer and delicatessen products demonstrate that a multi-billion dollar industries can be built on the back of producers that wish to experiment and consumers that wish to explore and make discoveries they can then share with friends (virtually or physically). The quest to discover new ethnic cuisines, unique flavours and innovative products will increasingly shape how people travel for holidays, the restaurants they choose to frequent and the retailers they purchase from.

Social issues re-shape the industry

The pressures on the agri-food system are increasing at the same time as almost 800 million people are under-nourished on a daily basis.

It cannot be overlooked that global population growth is predominately occurring in some of the poorest, most water-stressed, food-constrained regions of the world. The system is not delivering today; and yet it is expected to deliver more each and every day. This raises issues that will need to analysed and addressed by communities around the world, if we are to produce the food the world wants in a sustainable way in the long term.

These are big issues that should not be left entirely to Governments to address. They require broad community responses. There are no quick or easy answers to many of these questions, but they cannot be ignored:

- How do we produce enough food while retaining the productivity capacity of our environment, our water and our oceans for generations to come?
- How do we help the 800 million under-nourished and hungry people on the planet to feed themselves on a sustainable basis?
- How far do we go in using emerging technologies such as genetic modification and cloning to produce the food the world needs (given that many of the technologies have been developed in recent years and their long-term effects are not yet fully understood)?
- How does the global agri-food system evolve against the background of uncertainty and suspicion arising from Brexit, terrorism, immigration concerns and a shift towards protectionism?
- How do Governments develop food systems that extend beyond their borders to achieve the food security they seek.
- How do we take steps to prevent people from eating and drinking themselves to death through over-consumption of unhealthy products (particularly from the most disadvantaged parts of our communities)?

It is unlikely we will ever have a truly sustainable food system unless we answer these questions, and collectively take responsibility to implement substantive solutions. Leaving these issues unaddressed will increase social imbalances across society, and all that comes with that. Growing food inequality will increase the risk of social unrest, economic migration and, ultimately, could lead to the threat of war and increased levels of terrorism.

People

To ensure healthy lives, knowledge and the inclusion of women and children.

Planet

To protect our ecosystems for all societies and our children.

Partnership

To catalyse global solidarity for sustainable development.

Zero Hunger

End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

The Sustainable development goals include:

Dignity

To end poverty and fight inequality.

Prosperity

To grow a strong, inclusive, and transformative economy.

Justice

To promote safe and peaceful societies, and strong institutions.

Clean Water

Ensure availability and sustainable management of water and sanitation for all.

(Graphic above) 64 https://sustainabledevelopment.un.org/sdgs

Unbundling GMO technologies

SHAPING MEGAFORCES

Government 3.0

Targeted education

Fusion revolution

Facing resource scarcity

Scientific development in the area of genetics has been dramatic in recent years. The ability to manipulate an organism's genome using biotechnologies that can reorder or change the genetic makeup of cells has made clear headway.

It is potentially creating game-changing solutions for many of the fundamental challenges facing the global agri-food system. It is now possible, or will soon become so, to engineer plants that have the ability to withstand drought, crops that are higher in beneficial nutrients and protein, and animals that deliver more food for the feed they consume.

Significant controversy still surrounds these technologies. However. a range of 'genetically modified' cultivars are now in wide use in some countries around the world (estimates suggest that there is currently around 180 million hectares of GM cultivars planted). Concerns are often expressed over the possible impact these technologies could have on human health and the environment in the long term. In response to consumer concerns, many countries continue to ban or heavily restrict the use of these technologies in the agri-food sector.

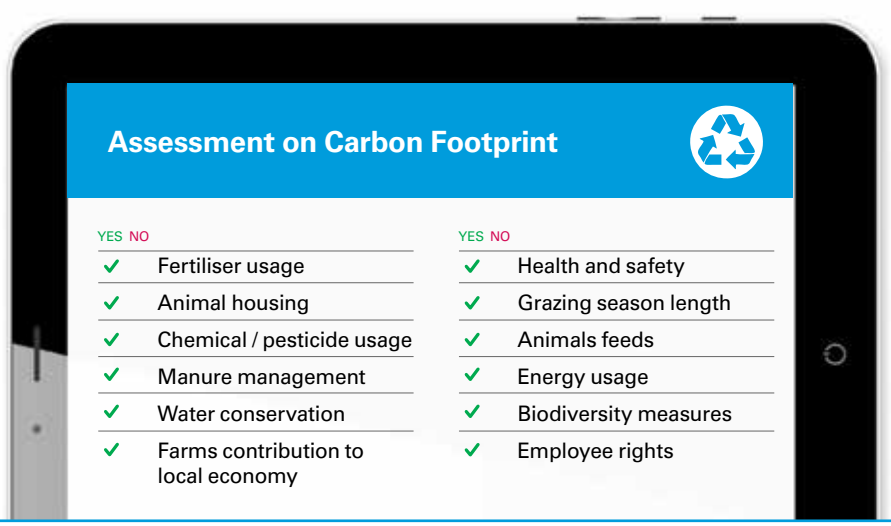
Those in favour of the technologies suggest consumer concern arises from a lack of education and understanding. Given that the science is highly complex, it is discussed in a highly simplified manner when addressed by the mainstream media. The term 'genetic modification' is a simplistic way to group a spectrum of technologies that vary dramatically, both in what they do and how they do it.

Some technologies are increasingly accepted around the world. Examples include marker-assisted breeding technologies such as **CRISPR-Cas9** (which simplifies and accelerates editing parts of the genome). Other technologies that have been developed are considered unacceptable and unnecessary by most people (transgenic animal species, for example and are yet to be widely commercialised).

We have become so used to grouping these technologies under the GM banner that any attempt to address them individually attracts suspicion that something is being hidden. In order to achieve a balance between community concern, consumer acceptance and economic wellbeing; perhaps we need to unbundle these technologies. That will allow us to better understand each technology, its individual potential and the associated risks.

A blanket restriction on using these technologies is unlikely to be sustainable in a world where scientific innovation progresses at speed. There is also an ethical issue; given the positive impacts the technologies can have on addressing food shortages in some of the world's most remote, unproductive regions. It is also fair to say that a carte blanche acceptance would concern all but the most rationale, informed members of the science community. A balanced approach to assessing these technologies is required. The goal is to fully understand the tangible benefits and risks of individual technologies, while leaving individual countries to design a regulatory environment that respects the concerns of their own community.

Implications: Developments of genetic technologies offers the potential to address many issues facing the global agri-food system; but we require informed debate and better understanding of their long-term impacts.



Developing multi-dimensional ethical farming systems

SHAPING MEGAFORCES

Given that the agri-food sector uses so much of the available land and fresh water on the planet, it's not surprising that society wishes to hold it to account. The way in which producers manage these critical assets attracts greater focus than many other sectors of the economy.

Discussions occur on a regular basis around what an individual farmer or an industry sector must do to secure and retain their ticket to play in high value markets. The standards that have to be met to supply the highest value markets are continuously rising. It is no longer considered appropriate to waste natural resources, and those that do will lose their ticket. Consideration of what is and is not acceptable now extends across many areas of operation. Among other things, it includes an organisation's commitment to mitigate its carbon footprint, treat employees ethically, restore the native biodiversity of its land, and minimise antibiotic use for animal health maintenance.

These are not simply 'nice-to-haves'. Organisations that fail to meet expectations are actively being excluded from markets. In the past year, a number of palm oil producers that have continued to clear native forest have lost export market contracts; while seafood companies that have been identified as using slave labour have been excluded from markets.

Maintaining market access requires organisations to firstly define the standards they will meet; and then set mechanisms they will use to monitor and report their performance. The framework needs to be aligned to consumer expectations.

Origin Green, run by Bord Bia in Ireland, has created a programme that sees every farm and food manufacturing business setting clear targets around sustainability, energy, waste, biodiversity and social sustainability. The Irish approach has placed sustainability in its broadest sense at the core of their agri-food sector.

Supporting gender equality in the global food system

The traditional image of a farmer is the burly, rugged outdoorsman. The reality is different. More women work in farming than men; they number in the hundreds of millions. UN Food and Agriculture data suggests that more than half of all women of working age are engaged in agriculture in Southern Asia and Sub-Saharan Africa. Women play a critical role in sustainably growing food around the world – whether tending small holdings, producing food to meet their family's needs, and often producing additional supply that can be sold for an income. Growing global production relies on enhancing the working lives of women in agri-food.

Empowering women will materially increase the sustainability of the global food system. This requires tailored education in best practices delivered directly into local communities, micro financing structures to support investment in new technologies, and the enhancement of local enterprises that connect communities to a value chain.

Implications: To secure and retain access to high-value markets, there is a need to clearly demonstrate the steps being taken to continuously improve the efficacy of production systems.

The cost implications of poor diets are unsustainable

SHAPING MEGAFORCES

As healthcare costs spiral, Governments around the world are finding it increasingly difficult to continue to fund leading-edge treatments; while insurance premiums continue to rise due to insurers' rising costs. The consequence of this inflation is forcing some Governments to look at alternative approaches to funding healthcare.

We expect the focus of public healthcare investment will rebalance – moving away from a predominantly curative approach towards preventative care. The logic of such an approach is clear. It reduces the investment needed in expensive social infrastructure such as hospitals; as well as reducing the impact on productivity, and the social cost of illness.

The investment into preventative healthcare will include programmes to educate people about healthy living – the importance of good nutrition, the role of exercise, and the need to minimise inherently unhealthy products in their lifestyle (like alcohol, tobacco, sugars and fats).

We are already seeing initiatives to reduce the profile of unhealthy foods; such as advertising restrictions, sponsorship bans, and advisories on portion sizing. For those consumers who are not taking the carrot, there will also be a stick. Sugar, fat and other tax regimes will be implemented to impose a cost on those who are not prepared to change their habits around unhealthy food consumption.

France was the first to introduce a sugar tax in 2012. Other countries have followed suit, with the UK jumping on the bandwagon earlier this year, and the momentum for these taxes is accelerating rapidly.

This follows the approach many Governments have taken to minimising the use of alcohol and tobacco in recent years. With the rise of obesity and other preventable eating-related illnesses, many countries will adopt taxes and similar measures.

However it remains important the objectives for the tax are carefully thought through. The impacts on food producers – and not just those that grow the directly-taxed product – could be significant. Business models may need reassessment, and innovative product solutions developed. Ultimately, farmers may need to change what they grow or invest in programmes to reposition their products in the market. **The Lifestyle Wines Research**[65] programme in New Zealand is a good example of this, with the industry investing collectively to creating better low alcohol wines.

Implications: As Governments refocus on preventing illness, taxes and other measures will have material consequences on the producers of certain staple food products.

65 http://www.nzwine.com/research/research-programme-1/major-programmes-1/pgp-lifestyle-wines-research-programme/

Other emerging themes...

Waste minimisation and food recovery programmes will driven by legislation and social enterprise.

The incremental demand for food over the next 30 years is well understood, as is the amount of food that is wasted. Around 70 percent more food is required, while around 40 percent of what is grown globally wasted. Fulfilling demand without proactive steps to manage and reduce waste will place significant, and potentially unmanageable, strain on the global agri-food system. Reducing food waste is not rocket science, there are many low hanging opportunities; only buying and cooking what we need to eat, using apps that create menu's from what is left in their fridge, re-purposing close to expired food into recovery programmes, utilising ugly (or not perfect) fruit and vegetables and, potentially most significant, improving handling and logistics practices in emerging markets.

Governments are recognising the benefits inherent in reducing waste, with countries like France and Italy taking a lead in introducing legislation designed to reduce food waste by requiring excess food to be provided to community food programmes. However, the real drivers of waste reduction will be social enterprises, looking for ways to feed the 800 million that are hungry every night and minimise mortality from malnutrition. These enterprises (some with a solely social purpose and others a dual social/profit lens) are working with Governments, companies, community groups and others to design better ways to direct the food we grow into people's mouths rather than to landfill or compost heaps. KiwiHarvest (case studied at the front of this Agenda) being an example of a distribution initiative taking excess food to charities.

Sustainability of often poor and disadvantaged rural communities.

The economic prospects for urban and rural communities are often markedly different. Wages, living standards and access to social infrastructure usually being significantly greater in cities. The world is experiencing the largest rural/urban migration in history with no signs of it slowing down for the next 30 years. Consequently, talented young people are leaving rural areas to seek their fortune in the city. We should be concerned about the sustainability of rural communities; our food is grown in these regions and as the previous sections have illustrated food production is getting more complex and specialised every day. Without talented people in rural areas the chances of producing the necessary food becomes ever more remote. Priority needs to be placed on maintaining the sustainability of rural communities; ensuring they have the infrastructure (education, healthcare, connectivity, water) to retain (or attract) the necessary talent away from cities.

Protection of ecosystems is a given; restoration of biodiversity is being sought.

Farmers will regularly claim they are the world's best environmentalists, they argue they have no choice but to use their land sustainably as their future is dependent on being able to generate a living from it. The problem they face is that urban communities around the world are increasingly questioning their stewardship of the environment. Stories of water and riverbed degradation, excessive soil erosion, unwarranted use of fertilisers, antibiotics and chemicals and the adoption of monoculture reliant production systems have all raised deep concerns around whether farmers are the guardians of the land they claim to be. As a consequence the expectations being placed on farmers are becoming more explicit. It is no longer enough just to demonstrate a holding pattern in respect of the environment. Buyers want to know what is being done to enhance ecosystems, preserve natural biodiversity, minimise non-organic inputs, plant riparian strips. They are increasingly looking to understand the practical steps being taken to restore the native characteristics of the land.

More emerging themes...

Fair trade becomes a norm rather than a differentiator.

FMCG companies have built brands on the back of coffee, chocolate, cotton and similar commodities sourced through fair trade channels. Paying a fair price to the grower for a base commodity has secured a premium price at retail for the finished product. Consumers have been prepared to pay a bit more to a company doing the right thing. The question for many consumers has become why should some producers be paid more than others, through luck of geography, for doing the same job; is it morally robust for companies to under pay the majority of their suppliers because a fair price is being paid to a few. As this ethical dilemma bites, fair trade will progressively become the norm. The challenge for companies will be how they effectively differentiate their premium products. Maybe one clue to this is the farmers milk initiative in the UK, where consumers have the option of paying a bit more for the farmers milk, the premium being paid directly to the farmer to lift their earnings.

Reducing energy intensity of farming takes farmers off the grid.

For many farmers around the world, three cost items dominate farm working expenses: water, feed and energy. Generating a profit relies on each of these costs being tightly managed, driving innovation in each area. Much is being done to minimise the energy intensity of farming systems; both through reducing the amount of power utilised, as well as seeking ways to capture the sustainable, renewable power inherent in the farming system. The opportunities to utilise effluent, waste biomass, the sun, geothermal and growing plants to produce energy is enabling more farmers to move off the grid and make themselves energy self-sufficient. With oil supplies mired in political instability, the shift towards a low carbon economy is accelerating; producers around the world are starting to recognise the economic and environmental benefits of leading this shift.

Giving people trust the food is what it says it is.

Most people in the developed world have grown up with certainty that the food inside the packet is the same as that described on the wrapper. Issues such as the horse meat/ beef scare in Europe, the blending of melamine into infant milk powder or, more recently, confirmation that much Manuka honey is not real Manuka honey, have highlighted what the emerging world has known for a while; there is money to be made passing cheaper product off as a high value food. The forgeries often go too far and people become ill (or die) from unsafe food. As trust in the authenticity of food declines, consumers will pay a premium for certainty over a product's integrity. Technologies including Blockchain (the digital tracing technique underlying Bitcoin), chemical fingerprinting of products and digitally unique labelling systems, as well as enhanced physical security of products as they move through a value chain, are being implemented to ensure the customer gets the experience they have paid for when they come to enjoy the product.

It's not about ideas. It's about making ideas happen.

– Scott Belsky, Author

We trust that we have again created a useful narrative to move the conversation forward on how the industry creates the value for its participants and the wider New Zealand economy. We would like to thank each and every one of our contributors who gave their time and their opinions so freely – without your input we would be unable to produce the *Agenda*.

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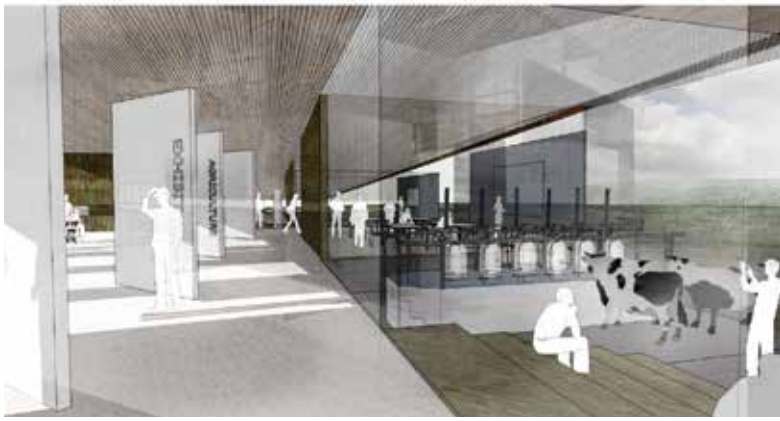
Growing the next generation of primary sector leaders.



The Experience Centre proposed for the ASB Farm at Mount Albert Grammar School creates the opportunity to educate young people in Auckland about the contribution the primary sector makes to New Zealand, the innovative practices the industry employs and the world class career opportunities that are available in many different disciplines.

The Centre will support the teaching of Agricultural and Horticulture programmes at Mount Albert Grammar School as well as providing an agricultural experience to over 20,000 Auckland school children a year, when fully operational. By engaging our youth we have the potential to embed our most productive industry into the prosperity of New Zealand.

The plans for the centre have advanced, with preliminary designs now complete and consents close to being applied for. There are many opportunities to get involved in the development and we need your help to enable the centre to be up and running for the 2018 school year.

Artist impression drawings above of the new building being constructed at Mt Albert

ASB · Mount Albert Grammar School · KPMG · Jasmax · Te Tumu Paeroa · Plant & Food Research

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