30 November, 2015

FUTURE NZ

Our smartest thinkers' predictions for the year ahead – and beyond

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Forward to the future

Shayne Currie
Managing Editor, NZME

"The future", declared Yankees baseball legend Yogi Berra, "ain't what it used to be".

Has ever a more mangled statement made as much sense? The Walkman, video cassette recorders, the fax machine - here yesterday, gone yesterday.

Technology is moving at breakneck pace. The iPhone is less than nine years old, yet it's revolutionised the way we interact and communicate. We're living in a mobile world - relentless and always on.

In October, we read countless articles about Back to the Future Day and just what the 1989 movie got right with its predictions of how the world would be in 2015. Flying cars, hoverboards, self-tying boots anyone?

The future fascinates us. How we'll be living and working, what we'll be eating, how we'll travel. And what of New Zealand's place in the global economy?

It's a delight to once again partner with Massey University to present Future NZ, our annual collaboration that sets out to challenge, explain, provoke - and to explore big ideas and how they will affect us.

Distinguished Professor Paul Moughan considers New Zealand's role in ensuring the world continues to produce healthy sustainable food and we outline five global food trends that we should be leading. Professor Paul Spoonley delves into latest immigration trends, and the new opportunities these create.

Next year Auckland will elect a new mayor. Massey public policy lecturer Grant Duncan lays out a new job description for the role to ensure the city shifts up a gear.

This time last year, we considered the All Blacks' chances of winning the 2015 Rugby World Cup. Mission accomplished. Today, our Olympians move into the spotlight. How many gold medals can we expect at Rio in 2016?

Here at NZME, publisher of the NZ Herald, we're embracing the winds of change. In two weeks we relocate to a world-class newsroom in central Auckland - a unique, state-of-the art facility with video and radio studios and an entirely new way of working. We're being driven entirely by audience demands - what, how and when we're reading, watching and listening.

Shortly, the NZ Herald's mobile audience will overtake the desktop audience, but what's next? The smartwatch is already here - smaller and even more personal than the phone. Short of embedding a microchip behind your ear, the news is closer than ever.

It's an exciting time - and today we're thrilled to offer you deep insights into the year ahead, and beyond.

Food and other revolutions

Steve Maharey
Vice Chancellor, Massey University

The future... no one lives there yet, but everyone is trying to work out what it will be like.

New Zealand, and the world, is in the midst of a period of extraordinary change that will transform the lives of everyone. As a university it is our job to help people understand what is going on and develop positive responses. We do this through our teaching, research, connections with the community, events such as our "New New Zealand Forum" and our partnership with the New Zealand Herald.

Over the past three years Massey University and the Herald have joined forces to produce Future New Zealand. The aim is to get people thinking about some of the big issues that will have a major impact on our lives. Last year we examined the dramatic changes taking place in New Zealand's population. This year the key topic is the food revolution.

Over the past three years Massey University and the Herald have joined forces to produce Future New Zealand. The aim is to get people thinking about some of the big issues that will have a major impact on our lives.

Food is, and will remain, one of the big issues of the century. In simple terms the world needs more food and better food sustainably produced. As a food producing nation New Zealand has a tremendous opportunity to make the most of the food revolution by moving what it does best up the value chain. Every single New Zealander, whether they are directly involved in food production or not, stands to gain.

But there is more to discuss about the year ahead. With the major United Nations climate change negotiations coming up in Paris this week, will New Zealand take a leadership role? How will "big data", the "internet of things" and robotics affect our jobs and lives? 2016 will also be a big year for politics and sport and our experts give their best insights and predictions for next year's local body elections and the Rio Olympics.

As you read this magazine, take the time to think about the future you want for this country and what we must do to get there. In the meantime, I wish you all the best for the coming year.

FUTURE NZ Editors: **Ewan McDonald** NZ Herald, **Sidah Russell** Massey University Art Director: **Xanthe Williams** Sub-editors: **Greg Fleming**, **Donna McIntyre** Advertising: **Darrell Denney**

THE FOOD REVOLUTION

New Zealand – the farm that could save the world

In a world where the population is ballooning and the environment is under pressure, producing enough healthy, sustainable food will be a global challenge – and New Zealand has an important role to play.

Paul Moughan
Distinguished Professor

The world is facing one of its biggest challenges – how to provide nutritious food for a predicted world population of 9 billion people by the year 2050. Not only is the world's population growing, but so too is the "middle class" – meaning a greater demand for processed foods and high-protein foods such as meat, milk, eggs and fish.

The challenge in producing the necessary volumes is considerable, especially when more than 600 million people in the world currently go hungry and many more suffer from micro-nutrient deficiencies. At the same time, in developed and developing countries, increasing numbers of people are overweight, predisposing them to a raft of diseases.

The problem is escalated even further when the potential effects of climate change and environmental degradation are considered. Not only do we have to produce much greater quantities of food and diverse dietary ingredients, but this must be done in an environmentally sustainable way and in the face of difficult-to-predict environmental changes. We simply cannot afford to produce more food at the expense of the environment.

The current world thinking is that food production can be met without bringing new land into production. That would be disastrous in terms of the loss of biodiversity and carbon emissions so it needs to be achieved by "sustainable intensification" and closing the difference between potential and actual yields.

It is easy to talk about sustainable intensification, but much harder to achieve this in practice. Factors influencing food systems and increases in food production are complex and multi-variable, differing from region to region and nation to nation.

There is a need for enlightened policies to guide increases in food production while, at the same time, mitigating environmental losses. The two processes are not mutually exclusive and we need to start factoring environmental costs into overall production costs, so that the true cost of food production is reflected in price.

Above: The sensory evaluation facility at Massey University.

The demand side also needs to be considered. Reducing food wastage must be a key target, and reducing the consumption of animal products produced from land directly competing for grain production needs to be carefully considered.

For the foreseeable future food will continue to be produced in rural and semi-urban areas and transported to cities. We will also need to develop more efficient systems and technologies for food storage, processing and distribution to cope with the increased demand.

So, what does this all mean for New Zealand? Our relatively small island nation will never produce enough food to feed the world, but we can become an international research, education and technology hub. We could become the place that develops best-practice production methods – the world's largest pilot farm, if you like – leading by example.

We need to become leaders in the transfer of agricultural knowledge and exporters of clever agrifood technology and education. The world is going to need many more agricultural and food

scientists, veterinarians, nutritionists and ecologists. New Zealand has always excelled in research and advanced training in these areas so we need to stand ready to play our part over the next 30 years.

Distinguished Professor Paul Moughan is co-director of the Riddet Institute, a national Centre of Research Excellence focused on food-related science, hosted by Massey University. He is also a member of a global think tank on world food security run by the InterAcademy Partnership, an umbrella group of the world's science academies.

Above top: A Massey University food technology student prepares a food analysis experiment.

Above: A spray dryer at the FoodPilot plant on Massey University's Manawatū campus.

IN VITRO MEAT OR INSECTS ANYONE?

As the production of meat declines what protein will be on our plates?

Corrina Tucker
Lecturer in environmental sociology with Massey University's School of People, Environment and Planning

If you look toward the future with an eye on food, and in particular with an eye on meat, you might find that you start to squirm. New Zealanders — like much of the developed world — are comparatively big meat consumers, averaging a little under 300g of meat each day. What's often overlooked is the impact this has economically, culturally and environmentally.

The world's population is growing rapidly and an increasing proportion of those people have higher standards of living than before. The environmental side-effects, combined with a growing demand for meat and other high-input resource foods such as dairy, means current meat consumption levels cannot be maintained forever. Projections suggest meat production will plateau by 2030 because of limited resources and environmental costs. So what will be on the horizon — or on our plates — in the foreseeable future?

IN VITRO (LAB-GROWN) MEAT

This is meat grown from stem cells in petri dishes. It sounds like the stuff of sci-fi movies, but it is very much a reality although — for a number of reasons, including commercial viability — it is likely to be a few more years before we see it on supermarket shelves. Although the 'yuck factor' means this product will require some aesthetic dressing up or disguising, it has many potential benefits. It could become a more environmentally benign way of producing meat, animal welfare factors are not such an issue, and its leanness means that it would be a healthier alternative to other meat products.

GMM — GENETICALLY MODIFIED MEAT

Genetic modification allows you to make animals 'do' things differently from their non-modified counterparts, including growing faster and being more environmentally friendly. Examples are salmon modified to grow more rapidly; the 'enviropig' (or 'frankenpig', depending on your view of GMO), which has been modified to decrease its phosphorus output and reduce harm to waterways; or cows that fart less to limit the amount of methane they produce. As with in vitro meat, many consumers will have reservations about eating something they deem as 'unnatural', but there's every likelihood that such flesh will be on our plates in future.

INSECTS

Endomophagy (eating insects) has been receiving a fair bit of media attention in recent years — and for good reason. Insects are widely eaten in different parts of the world and provide a lean source of protein that is often abundantly available. The 'yuck factor' is again a consideration here and some aesthetic work may need to occur for such foods to be deemed more palatable to those not accustomed to eating them. Mealworm, crickets and grasshoppers are popular candidates for mini-livestock production.

NOSE-TO-TAIL CONSUMPTION

While not new, nose-to-tail consumption is, as the name suggests, eating as much of an animal as possible in order to waste as little as possible. The environmental benefits of consuming everything from offal to pig trotters comes from limiting waste and reducing demand. This eating practice is experiencing a renaissance moment with some celebrity chefs exalting the taste sensations you get from consuming animals' lesser-eaten parts (in a New Zealand context at least).

NON-MEAT PROTEINS

If all of the above leaves you a little nauseous, the simplest idea is to eat non-meat proteins. This doesn't have to be the specifically-designed vegetarian products made to replicate meat — and it does not have to mean forgoing meat completely. It could simply be a well-balanced diet that includes a combination of vegetables, legumes, nuts and grains that, together, provide all the sustenance that humans require, with meat playing a much lesser role. ●

THE FOOD REVOLUTION

The global food trends New Zealand must lead

Producing enough healthy, sustainable food will be a global challenge, but it also provides a local economic opportunity.

New Zealand's food industry is already a strong player internationally in the efficient production and processing of animal products and has a reputation for high quality and strict safety standards, says Distinguished Professor Harjinder Singh, director of the Massey Institute of Food Science and Technology.

"We must maintain this competitiveness and further enhance our ability to innovate if we are to capture a larger share of the massive growth in demand," he says.

"Whether it's developing strong brands for specialty cheeses, yoghurts and fermented meats, or creating natural functional foods for the health-conscious middle classes, New Zealand will need to maintain world-class programmes in food research and training, underpinned by investment from government and industry."

Fortunately New Zealand has an excellent research base through its Crown Research Institutes and universities. And, in recent years, a number of cross-institutional and cross-discipline collaboration networks (for example Riddet Institute, Food Safety Science Centre, and the High Value Nutrition National Science Challenge) have brought the nation's scientific resources together to bear on specific food issues.

We asked Massey University's food and agriculture experts to identify the five key trends New Zealand must lead if it's to protect its economic future.

GENETIC MODIFICATION FOR GOOD

Science and technology will play a key role in solving complex food production challenges, according Professor Singh. "The latest developments in genetic modification and nanotechnology show great promise in increasing plant and animal productivity, with minimal environmental impact," he says.

This area of science has the potential to reduce the need for irrigation and pesticides, while reducing greenhouse gas emissions, enhancing food safety and improving the nutritional quality of products. It could mean clover that doesn't cause bloat, ryegrass that can survive drought conditions and kiwifruit that doesn't get Psa, says Professor Peter Kemp, head of the Institute of Agriculture and Environment.

"The world is in the middle of a genetic revolution but, when it comes to agriculture, New Zealand is in a time warp created by the 2001 Royal Commission on Genetic Modification," he says. "We make use of molecular genetic techniques to improve our breeding of agricultural plants and animals but we do not use genetically modified plants or animals. Yet other countries do, and we use their products."

Science will have to overcome the hurdle of public opinion before farmers can take advantage of genetically modified crops and consumers are willing to eat them.

PRECISION AGRICULTURE

Professor Kemp also believes precision agriculture, using GPS (global positioning system), sensor technology and robotics, has the ability to revolutionise the agricultural sector by decreasing both production and environmental costs. Clever weed control and precision fertiliser application systems are a good example, he says.

"Sensors on sprayers can recognise weeds so the use of herbicide is kept to a minimum. Fertiliser applied from a plane can be targeted to pastures that will respond, with poorly responsive areas such as steep slopes or environmentally sensitive areas like wetlands left untouched."

Meanwhile, Massey University's Fenix hyperspectral sensor gives a peek into the future of land monitoring. "It can be used to map whole catchments from a plane to determine the pasture production and feed quality, fertility of the pasture, the pasture species present, tree diseases, slope erosion and other variables," Professor Kemp says.

"In the future this technology will be used to monitor the health and productivity of agricultural and indigenous vegetation over whole river catchments regularly so action can be quickly taken as required."

FOOD SOURCES YOU CAN TRUST

The city dwellers of the future, particularly in Asia, will continue to demand foods that are rich in animal-derived proteins, characterised by the consumption of fresh meat and milk.

"Animal products are generally seen as nutritious and healthy – particularly dairy – by these consumers, but they are highly susceptible to risk of contamination," says Professor Singh. "Ensuring safety across all aspects of animal production and processing, as well as distribution systems, will become even more critical in the future."

Another key trend, Professor Singh says, is the traceability of products as consumers increasingly pay attention to the origin of their food and whether it is safely and sustainably produced.

FUNCTIONAL FOODS FOR PERSONALISED NUTRITION

In developed markets there is a gowing demand for more specialised protein products that are tailored to a person's individual nutritional needs. This trend is reflected in functional foods, where staple foods have health-promoting minerals and nutrients added to them.

"The co-processing of milk and meat protein components with other uniquely New Zealand products – for example manuka honey and kiwifruit – offers a huge opportunity," Professor Singh says. "There is great consumer interest in the health-promoting properties of 'natural' functional foods and their ability to prevent the onset of diseases like diabetes, coronary heart disease and cancer."

BACK TO THE FUTURE FERMENTATION

Professor Richard Archer, the national leader for a new $16.65 million research project into food processing, says processed foods get bad press, but it wasn't always this way. "Seventy-five years ago it was the opposite," he says. "Only the poor made do with in-season, local food. The rich chose processed for safety and for out-of-season variety.

Today, while modern preservation techniques strive to preserve nutrients while killing bugs, he says, it's the treats section of the supermarket aisle that is one of the food industry's biggest growth areas and "a large part of processed foods' villainy".

Professor Archer says one of the really exciting processing trends is fermentation – it's a traditional method that consumers understand that has many health benefits. Unlike the refining processes of many food staples, fermentation doesn't lead to the loss of fibre, micronutrients and healthful phytochemicals.

"The fermentation process adds vitamins, renders inedible foods digestible, destroys pathogens and adds tang!" he says. "The challenge, then, for food scientists is to develop the processes to produce fermented foods at an industrial scale, while maintaining those features that consumers associate with healthy 'unprocessed foods'." ●

HEALTH

The future of medicine is inside your body

Bacterial cells outnumber the human cells ten to one. And, without these microbial companions, we would die.

Heather Hendrickson
Senior lecturer in Molecular Biosciences at Massey University

You are not the lone resident of your body. You are more like the captain of a team of millions of individuals, each self-interested but wearing your jersey. Recent studies suggest that people with more diverse populations of bacteria living in their guts are less prone to obesity, cardio-vascular disease and diabetes. In fact, the one out of four individuals with low microbial diversity appear more likely to gain weight and gain it more quickly than their high-diversity friends.

More than being indicators of our tendencies, microbes may be directly engineering our metabolism or modifying the way our bodies encounter nutrients. For example, in mouse studies, exchanging the microbes of a thin mouse for those from an obese mouse increased the mouse's weight without dramatically changing the diet.

We are still learning about these complex interactions and which specific organisms might be responsible but it's an important area for the medical and agricultural sectors. If a doctor or veterinarian is considering only the health of the team captain and ignoring the rest of the team, it will not be a great season.

In the future, we may be able to treat conditions such as obesity and diabetes simply by adjusting the levels and diversity of microbes in our systems, rather than taking drugs. And our metabolism is just the beginning. There are hints that our microbes are sending chemical signals that affect our psychological and emotional function as well.

Scientists recently discovered that some soil microbes increase our levels of serotonin, a neuro-transmitter found to have a calming effect on temper and to increase intelligence.It has been suggested that this alteration in our mood may make us more social, allowing the bacteria to be transmitted between hosts and therefore to multiply.

In the future it may be possible to take an asthma-style inhaler full of friendly, uplifting microbes when you are having a bad day – instant warm fuzzies. Imagine stopping off at a food outlet for a delicious fruit shake with a microbial additive that will help you focus in class or get over that disastrous crush on your neighbour.

A new review suggests that by 2050 the number of individuals who will die of antibiotic resistant superbugs is expected to outpace even cancer at an estimated 10 million people per year. Much like the "peak oil" crisis, the "peak antibiotic" point has likely transpired. The hunt is on for the next set of solutions to this worldwide health crisis.

Another promising area of microbial research is the acceptance of a form of medicine that saved lives during the first half of the 20th century. Bacteriophages (phages for short) are viruses that seek out and destroy specific bacterial targets in order to replicate themselves. These entities have been the natural parasites of bacteria for billions of years and they are very good at it.

Phage therapy is the application of a cocktail of appropriate phages to combat specific bacteria. The beauty of phages as medicine is three-fold. They are extremely specific to particular pathogens and can be tailored to suit. They replicate themselves when they destroy their targets, enhancing effectiveness at the infection site. And when the infection is gone, they simply leave the system to be recycled naturally.

Cold war era politics kept the lessons of appropriate phage use outside of the mainstream but it looks increasingly likely that phage therapy will be approved for use in humans once again.

Gone will be the days of taking an antibiotic with broad-spectrum killing of the important and beneficial micro-organisms in our bodies. ●

CLIMATE CHANGE AND ENVIRONMENT

Halve our emissions by 2030? Yeah, right

With a bit more ambition New Zealand could lead the development of innovative climate technologies.

In the run-up to the major United Nations climate change negotiations taking place in Paris this week, all countries were required to submit their "intended nationally determined contribution" in advance. New Zealand's stated target is a 30 per cent reduction in greenhouse gas emissions below our 2005 levels by 2030.

This has been heavily criticised as being far too weak, especially given the Government's intention to meet most of the target by buying carbon credits from offshore rather than by trying to reduce our continually growing total emissions. But there are cost-effective solutions available to bridge the gap, and many have co-benefits such as improved health and employment opportunities, so why not encourage their uptake?

More than 80 per cent of our electricity generation comes from renewable hydro, geothermal, wind, bioenergy and a tiny bit of solar. Our electricity is therefore "low-carbon" compared with most countries, even without any Government interventions to encourage this.

We have a target in place to increase the renewables share to 90 per cent by 2025 but, other than the weak and ineffective Emissions Trading Scheme, no policies are yet in place to ensure it happens. The government's Smart Grid Forum is evaluating the opportunities that supporting integrated, small-scale, renewable power generation systems might deliver in the future, in conjunction with electric buses, e-trains and e-bikes as well as e-cars. There are around 800 e-cars already running around New Zealand.

Further in the future, a more flexible electricity grid, encouraging small-scale distributed generation, and integrating a larger share of variable wind and solar into the power generation mix without risks of power outages, would – and should – enable 100 per cent renewable electricity to be achieved.

Heat is a different story. Most of the demand for industry and buildings is currently met by burning coal and gas. But low-carbon, renewable alternatives are available and their uptake is growing. These include solar thermal for heating water and zero-energy buildings; geothermal heat for timber drying, prawn farming and so forth; woody biomass for making paper pulp and heating greenhouses; and wood pellets for heating homes, schools and other buildings.

It is also technically and economically feasible for Fonterra to stop burning coal and use renewable heat in its milk processing plants instead. In anticipation of the international price for emitting carbon dioxide increasing, it would make good business sense for coal to be displaced, and in some situations, even natural gas that also emits carbon dioxide.

Obtaining the desired energy services of comfort, mobility and lighting, but using less energy inputs as a result of using the energy more wisely is well understood. However, energy efficiency is still not widely implemented. New technologies, such as LED light bulbs, can reduce the energy demands, but even greater savings could be made by behavioural changes such as turning off appliances when not needed, or driving slower to reduce fuel consumption. Unfortunately, changing human behaviour is a real challenge, even when money can be saved.

For example, the transport sector has the fastest growth in emissions but many politicians seem loathe to discourage the use of cars (especially for short journeys), support the purchase of more fuel-efficient vehicles or expand the public transport system.

A person chooses either a private car, taxi, scooter, bus, train, plane, cycle or walking for a journey based on a mixture of cost, convenience, comfort, speed and safety. To break our dependence on the car requires making it easier and beneficial when travelling by other modes of transport. As well as reducing greenhouse gas emissions, the co-benefits are relieved traffic congestion, improved air pollution, better health through exercise, and saving money. According to the AA, the full cost of owning and operating a car is around $1 to $1.50 a kilometre travelled.

In the not-too-distant future, Uber taxis, electric vehicles, driverless cars, internet shopping, developments in social media and urban planning to encourage walking and cycling will reduce the desire for many people to own a car. Shifting freight from trucks to trains and coastal shipping will also be faster and cheaper as well as producing lower emissions.

All these developments are cost-effective and within our reach. With a well-educated population, New Zealand has the opportunity to greatly reduce its greenhouse gas emissions and gain all the co-benefits that come with it. With a bit more ambition, we could also lead the development of innovative climate technologies – surely a guaranteed growth market – and show the world what can be achieved.

Unfortunately our "intended contribution" to reducing emissions is lower than that of most other countries, even Australia. We may only produce around 0.17 per cent of the world's total greenhouse gas emissions but, per person, we are around the fourth highest globally. Greater action now to reduce our emissions will help avoid some of the future high costs involved with having to adapt to extreme weather events and the need to become more resilient to them.

With biodiversity losses, dirty rivers, increasing traffic jams, local air pollution, high obesity levels, and rising greenhouse gas emissions, New Zealand's environmental leadership has badly slipped. There is still a chance to halve our greenhouse emissions by 2030 and regain our "clean, green" status – but, sadly, that opportunity is slowly slipping away. ●

Ralph Sims
Professor of Sustainable Energy at Massey University. He is also a long-time contributor to the Intergovernmental Panel on Climate Change

CLIMATE CHANGE AND ENVIRONMENT

What's your water footprint?

In a world with increasing levels of industrialisation and urbanisation, solid 'water credentials' could give New Zealand a competitive advantage.

Sarah McLaren

Ranvir Singh

"Water is probably the only natural resource to touch all aspects of human civilisation, from agricultural and industrial development, to cultural and religious values embedded in society," says Koichiro Matsurra, former director-general of Unesco.

As well as being vital for human society, water plays a key role in sustaining ecosystems around the world. Unfortunately, we are entering an era of increasing freshwater scarcity due to the over-exploitation of renewable but finite resources in large parts of the world.

But much of this water use is effectively hidden from us, its final users. Each of us, on global average, uses nearly 25 times more water indirectly (about 3800 litres per person per day) in the form of products and services compared to direct water use in our households (about 150 litres per person per day).

There is growing concern around the world that the increasing population, industrialisation, urbanisation and changing lifestyles cannot be sustained if we continue on our current trajectory of water use. Instead, we must start using more water-efficient products and changing our everyday practices.

But how will we know which products are more water-efficient? And how can companies develop and market more water-efficient products? Water footprints are able to answer these questions, and are already used in environmental certification programmes such as the Australasian Environmental Product Declaration Programme, carboNZero and GreenStar. Globally, companies such as Unilever and Nestlé are using water footprint information about their products to guide their sustainability programmes.

A water footprint accounts for both the direct and indirect use of water and its associated environmental impacts during the production and use of a product or service. The concept was popularised by the Water Footprint Network in the early 2000s and more recently the International Standards Organisation (ISO) has published an ISO standard to guide water footprint studies. These initiatives, and a rapidly increasing body of academic research on water footprint methods, have begun to untangle and clarify the complexities in assessing the environmental impacts associated with water use.

In New Zealand, this work has taken place through research undertaken by the partners in the New Zealand Life Cycle Management Centre, and through individuals participating in development of the ISO Water Footprint standard. It is expected that, over the next few years, consensual water footprint methods and verification/certification systems are likely to be developed and introduced into the international marketplace.

Then companies will be able to credibly demonstrate the "water credentials" of their products and achieve competitive advantage. Water footprinting will become a mechanism for business organisations to assess their water-related risks and opportunities, demonstrate their environmental stewardship, and gain access to premium markets.

Fresh water in New Zealand is, by international standards, abundant due to plentiful rainfall across the country. Not only is it essential in producing the agricultural products that are the backbone of the nation's economy, it also plays a fundamental role in attracting international tourists and sustaining the quality of life enjoyed by New Zealanders. Responsible environmental stewardship of water has potential to deliver competitive advantage in the international marketplace.

So, what is required in order for New Zealand companies to demonstrate responsible environmental stewardship? First we must engage with emerging international initiatives such as the European Commission's Product Environmental Footprint programme. Then we must collect the data required to assess and reduce the impacts on our freshwater resources. Finally New Zealand must develop, test and implement water footprint management programmes in different industry sectors.

In a world where greenwash is no longer tolerated, our ability to retain a competitive advantage for products based on "the New Zealand story" is dependent upon proactive and positive engagement with this agenda.

Professor Sarah McLaren and Dr Ranvir Singh are researchers at Massey University's Institute of Agriculture and Environment.

BUSINESS

Can tourism save our economy?

With a bit of diversification, Professor Harald van Heerde believes it can.

Harald van Heerde

Holder of the MSA Charitable Trust Chair in Marketing at the Massey Business School and the highest ranked marketing scholar in Australasia

Many of us follow the ups and downs in dairy prices as closely as we follow the All Blacks. As a country we depend a lot on the price cycle of dairy – many commentators would argue too much. The key problem is that milk is a commodity that is mass-produced in other places, especially since the EU has lifted its quotas.

But we do have a unique selling proposition with tourism. We may not notice it when we are stuck in our daily traffic jams but New Zealand is blessed with features that make it a very attractive destination. The scenery is stunning, it is compact, the main language is English and it is generally safe to travel here. That's why international tourism has grown to a $10 billion industry, edging closer to dairy as our No 1 export earner. Travel and tourism (including domestic) constitutes close to 15 per cent of the country's GDP.

The problem is that tourism is also highly cyclical, even more than the economy as a whole. Holidays are the first thing consumers cut back on when the economy turns sour. So if a country goes through a downturn, visitor numbers from that place dry up, especially because New Zealand is a faraway destination for 99 per cent of the world's population.

My research has shown there are several things we can do about this. While we cannot control the world's business cycles, we can ride them better. For most sectors, ups and downs in business cycles are different in nature: downs are quick and deep, and ups are slow and gradual. Interestingly, this does not hold for tourism. Compared to the rest of the economy, tourism bounds back faster after a downturn. When consumers have just gone through a recession, they want to reward themselves with a nice holiday. So tourism can be the engine for kick-starting the economy after a recession.

Another insight is that countries do not go through peaks and troughs at the same time. Unlike dairy prices, where we put all our eggs in one basket, international tourism is driven by the economic situations in different countries. For example, Europe and Australia go through quite different cycles, and the same applies for North America and Southeast Asia. So if one region is sluggish, we can turn our attention to other, improving regions.

Another interesting finding is that countries are more responsive to our tourism marketing in downturns because there is less competition from competing destinations. I have also found those countries with the most volatile economies have the biggest long-term growth potential for tourism to New Zealand – China, Indonesia, and South Korea are good examples.

Another natural buffer is that many visitors come here to visit friends and relatives. This group is much less sensitive to the business cycle than regular tourists. In the light of the recent surge in immigration numbers, especially from Asia, we can expect many followup visits by friends and family members in the years to come.

As a country we can – and should – further boost visitor numbers through tourism marketing. Tourism New Zealand spends roughly $120 per year million on promoting this country overseas, which may sound like a lot but it is about 1 per cent of international tourism revenue.

After analysing the return on New Zealand's tourism marketing investment, I found for every dollar spent, we earn around a net $2 for the economy. That is a great return on investment, and I believe Tourism NZ should be applauded for its efforts. But we could earn even more if the Government and its partners invested more in marketing, and if they invested it smarter.

Tourism is a great way to kick-start an economy after a recession.

Many international firms, as a rule of thumb, spend 5 per cent on marketing and big firms sometimes even up to 20 per cent. Given the effectiveness of the spend, I believe the Government should increase its international tourism marketing budget by at least 50 per cent.

I have also calculated the return on Tourism NZ's current marketing spend if it was allocated differently, with an eye to diversifying better across countries and the business cycle. I am confident that a nett gain of around $80 million can be made for the economy.

Making New Zealand more accessible also helps a lot. The country achieves great returns every time the number of flight connections increases. Direct routes from Auckland to populous countries like India, Brazil, Philippines, Indonesia (other than Bali) or Mexico could do wonders.

We also need to think about the way we promote our country. For too long, New Zealand has relied on its scenery to appeal to tourists. As a result we attract a lot of backpackers and tour buses visiting the obligatory highlights. Catering for a wide range of holiday styles allows us to spread tourism streams more evenly over the seasons and around the country. 100% Pure New Zealand is great, but limited, and it's time to diversify the experiences we market as well. ●

ADAPTABILITY KEY TO SUCCESS

Businesses must embrace change in order to access new markets and customers. By **Liam Dann**

Liam Dann
Business editor of The New Zealand Herald

Let's face it jobs aren't for life anymore. Even if you have a one secure employer for the entirety of your career that companies business model will change and so will your job.

Modern employees are expected to be flexible and able to constantly adapt to a changing business environment.

The pace of change in the economy and the wider business environment is almost overwhelming. Disruption is the buzzword, although in the past few years it has gone from a trendy piece of tech sector jargon to mainstream of corporate thinking.

Those in the media industry have been confronting the disrupting nature of technology for several years, but increasingly every facet of the business world is facing a disruptive challenge thanks to the way technology enables consumers to get what they want more easily – often without needing to deal with traditional retailers. The speed of technological transformation is so fast that it has become almost impossible to predict what the next big trend will be.

So how should we be equipping the next generation for the job market?

Social media marketing? Coding computers? Speaking Mandarin?

There are plenty of skills that look set to be in demand over the next decade or so. But beyond that, an entrepreneurial mind set looks like one of the biggest assets we can encourage.

Kids starts surfing, kids start rock bands. The smart ones are starting start-ups.

Just like most efforts to take over the music world most start-ups will fail. But the experience will give them skill that will be crucial for doing business even with the world's largest corporate organisations.

Entrepreneurship embraces change as opportunity. It is not shy of risk but it learns to manage it well – or it fails. But the best entrepreneurs know how to do that well too.

Thousands of small companies start up every day around the world all anticipating the next big consumer trend - only a handful will get it right and thrive.

Fail fast, fail often but keep moving, learn and try again. It is almost a mantra in the world of tech start-ups.

When it comes to disruption it has been the increasingly powerful influence of the internet that has many industries reinventing themselves and questioning the notion of "business as usual".

That trend towards an accelerating pace of change is not really new. Writer Alvin Toffler described it in his 1970 book Future Shock. He summarised the notion of future shock as: a negative reaction to "too much change in too short a period of time".

You'd think, given the staggering pace of change that has taken place since 1970, that we'd all be immune to it by now.

Younger generations are more comfortable with it but in the end humans haven't changed their biology. We're probably hardwired to worry about change.

The harsh reality is that some people cope less well with uncertainty than others. Some people will be more naturally inclined to entrepreneurship.

But if we can bring the next generation of workers through to think in terms of opportunity - whether that be creative or business - the more equipped they will be for change.

The other big change and challenge facing the New Zealand business is demographic.

Businesses are at risk of being left behind if they do not address the changing cultural mix of their customer base.

This isn't simply a matter of window dressing to make different ethnic groups feel included or welcome - admirable as that may be.

It is a pressing economic reality.

Eurocentric businesses that struggle to understand and communicate with a wide range of ethnic groups will fail to sell to them.

By 2038 over half of New Zealand's population will be either Maori, Asian or Pacific Island. In fact that is close to the current breakdown in Auckland now, according the recent Super Diversity Stocktake report produced by Mai Chen.

Again these changes represent a huge opportunity for New Zealand businesses - something the Stocktake report calls the diversity dividend.

A key driver of success for our young people in the business world is going to be cultural intelligence.

Those taking that with them into the workforce will have an edge in access new markets and customers from the growing ethnically diverse mix of the New Zealand population.

Faced with rapid change on all fronts it can be tempting to push back.

But if we are to steer change in the right direction we need to go with it and do our best to embrace it.

The challenge for New Zealand educators and employers is to create environments that foster risk taking and creativity. With that kind of platform set for them our young leaders will be equipped for face whatever the future brings. ●

For more Future New Zealand content go to http://futurenz.massey.ac.nz and nzherald.co.nz/go/futurenz

Left: Businesses are at risk of being left behind if they do not address the changing cultural mix of their customer base.

BUSINESS

A robot stole my job: Preparing for the new age of automation

Artificial intelligence is predicted to overtake human intelligence in the mid-2020s. What will this this technological revolution will mean for the future of work?

Ted Zorn
Pro Vice-Chancellor and Dean of the Massey Business School

The latest sports or financial news you read in this paper could have been written by a computer without you even noticing – one of the signs that we are in the midst of a revolution potentially more transformative than the industrial revolution.

That revolution moved humankind from manual to machine labour, and brought dramatic social changes and standards of living. The current revolution, driven by rapid advances in information and communication technologies and biotechnologies, will similarly bring massive changes in how we live and work. While the benefits are potentially huge, so are the dangers. Machines churning out news stories, along with driverless cars, 3D-printed human hearts and memory-recording MRI scans are just the beginning.

The speed of innovation, particularly in chip processing and memory capacity, means a near exponential rate of development is ahead of us. Artificial intelligence (AI) expert Neil Jacobstein predicts that AI will overtake human intelligence in the mid-2020s.

Experts nervously debate what this technological revolution will mean for the future. There is no question there will be heavy disruption to employment patterns as ever-increasing numbers of jobs face automation. Jobs that are routine and repetitive are of course already being replaced. Checkout clerks, tax preparers, bank tellers and telephone operators are quickly disappearing. Many other service and retail jobs could soon go the same way.

However, jobs that require complex pattern recognition and non-routine cognitive tasks are not immune from automation. Ten years ago driverless cars were an impossible dream because of computers' inability to recognise and respond to rapid changes in traffic and road conditions. Today Google's independent cars are already proving more reliable than human drivers.

The impacts on the logistics and transport industry of this technology could be huge, affecting taxi drivers, couriers and pilots, among others. Similarly, 'big data' already enables computers to carry out some activities faster and better than a human. They can already identify fraud faster than an accountant or diagnose illness better than a doctor. One study predicts that 47 per cent of jobs could become automated in the next 20 years.

New Zealand will not be exempt from automation. Two of our most important industries – agriculture and tourism – will undergo significant change in the coming decades. Agriculture and horticulture will increasingly see agricultural robots (agbots) automating processes such as harvesting, fruit picking, ploughing, weeding, planting and irrigation, particularly on commercial farms. Hundreds of agbots equipped with microscopic sensors could coordinate and work the land with minimal human intervention within the next 10 years.

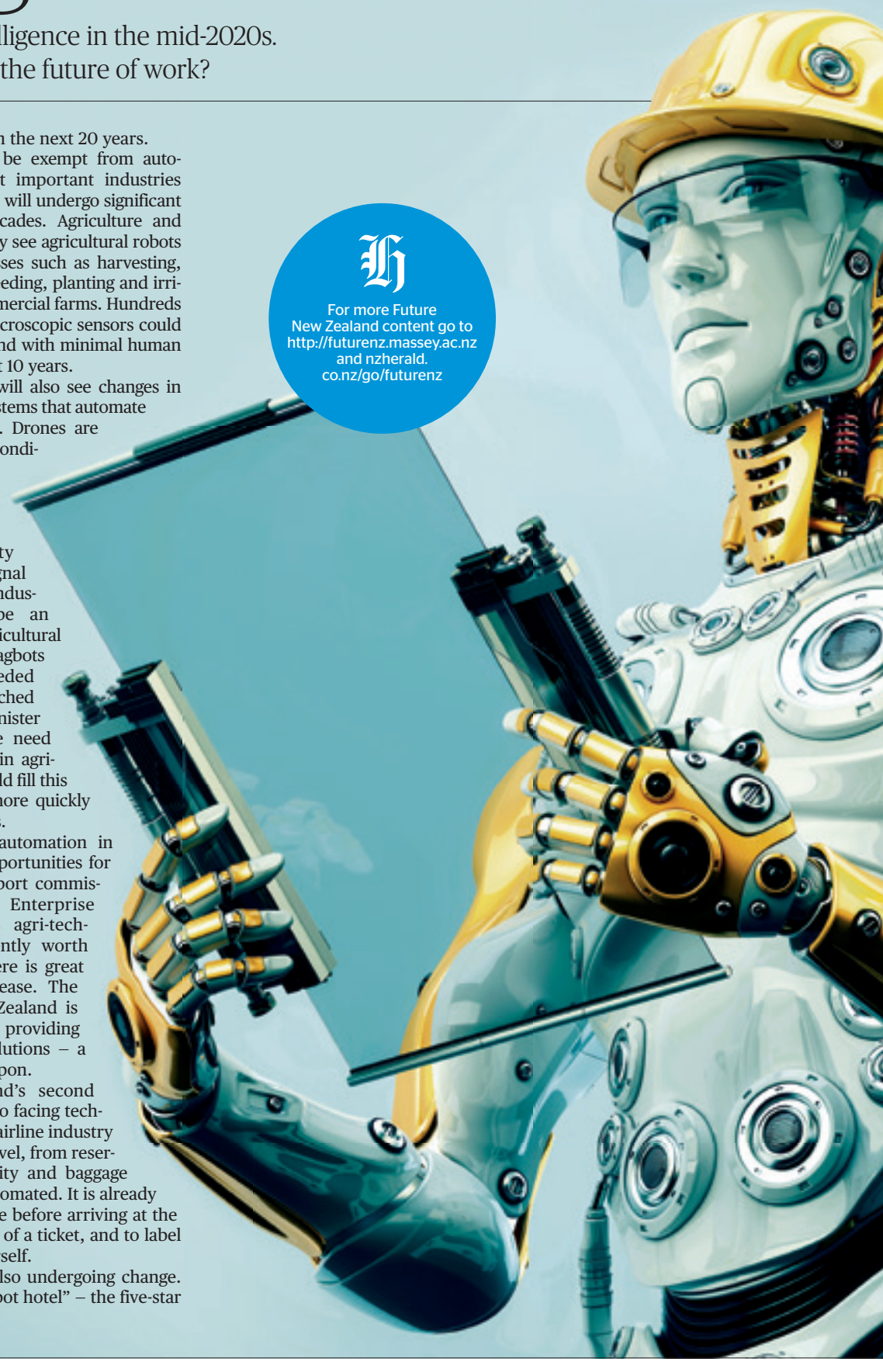
The dairying industry will also see changes in the pipeline with robotic systems that automate the entire milking process. Drones are already monitoring farm conditions as they are quickly able to reach hard-to-access areas faster than a farmer ever could.

While the possibility of automation might signal warning bells for many industries, agriculture may be an exception. A shortage of agricultural workers is foreseen, and agbots could provide much-needed labour. A recent report launched by Primary Industries Minister Nathan Guy highlights the need for 50,000 more workers in agriculture by 2025. Agbots could fill this gap, working longer and more quickly and without human injuries.

The development of automation in agriculture also creates opportunities for New Zealand. A recent report commissioned by Trade and Enterprise estimates New Zealand's agri-technology exports are currently worth $1.2 billion a year and there is great potential for this to increase. The report also showed New Zealand is emerging as a leader in providing agricultural technology solutions – a strength we should build upon.

Tourism, New Zealand's second largest export earner, is also facing technological innovation – the airline industry being a frontrunner. Air travel, from reservations to check-in, security and baggage handling is increasingly automated. It is already the norm to check-in online before arriving at the airport, use an app instead of a ticket, and to label and deposit your bags yourself.

The hotel industry is also undergoing change. In July the world's first "robot hotel" – the five-star



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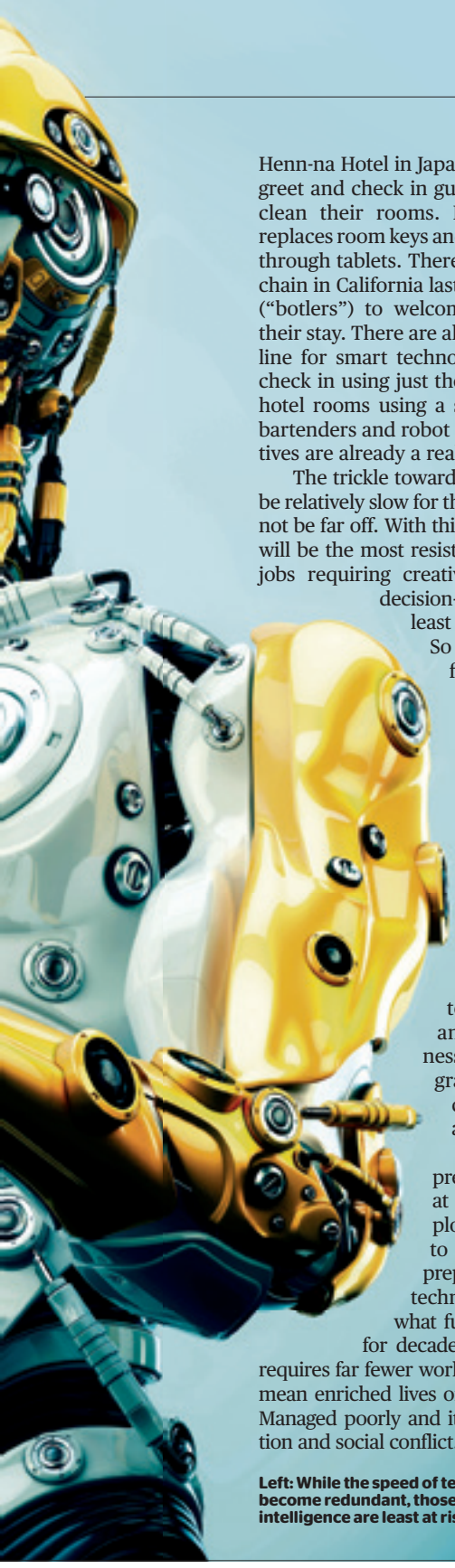

Henn-na Hotel in Japan – opened its doors. Robots greet and check in guests, carry their luggage and clean their rooms. Facial recognition software replaces room keys and guest requests are managed through tablets. There are other examples: a hotel chain in California last year launched robot butlers ("botlers") to welcome and assist guests during their stay. There are also developments in the pipeline for smart technologies that enable guests to check in using just their fingerprint, or open their hotel rooms using a smartphone as a key. Robot bartenders and robot customer service representatives are already a reality.

The trickle towards the automation of jobs may be relatively slow for the moment, but the flood may not be far off. With this in mind, which occupations will be the most resistant to automation? High-skill jobs requiring creativity, social intelligence and decision-making are least at risk, at least in the short to medium-term. So managers and social workers, for example, repeatedly show up in the "safe" category. But some low-skill jobs – home-care and cleaning, for example – will also be largely unaffected in the near future.

As a business school dean, I think a lot about how we prepare our students for the future. We must ensure students are tech-savvy and can work effectively with new digital tools. A willingness to use technology to complement and enhance our effectiveness is critical. We must ensure graduates are also equipped to continuously learn, innovate and adapt.

Policymakers must also prepare for a future that could see at least temporary mass unemployment, both by preparing to retrain large numbers and preparing for the possibility that technology will finally lead to what futurists have been forecasting for decades – an economy that simply requires far fewer workers. Managed well, this could mean enriched lives of more leisure and fulfilment. Managed poorly and it could mean massive disruption and social conflict. ●

Left: While the speed of technology means some jobs will become redundant, those requiring creativity and social intelligence are least at risk.

Who's running our companies?

Deborah Russell
Taxation and business lecturer with the Massey Business School

There are more men named David running New Zealand companies than there are women. That is, women of any name. There are also more men named Mark, Christopher and Michael, and just as many Johns and Graemes or Grahams

That's what an analysis of the first names of CEOs of all the entities (companies and investment funds) listed on the New Zealand Stock Exchange (NZX) tells us.

Looking at the chairmen of listed firms, the same pattern of names appears. There are more men named Peter, David, John and Chris than women of any name chairing NZX-listed firms, and just as many men named Michael (see the tables for a summary).

Of the 270 or so people who are either CEOs or chairmen of NZX-listed firms, about 4 per cent are women.

At first glance, the news is somewhat better for directorships. Using the same technique of counting each individual only once, there are 744 directors of NZX-listed firms. Of these 104 (14 per cent) are women.

Even so, it's still a man's place around the board table. Sixty firms have all-male boards and no firms have all-female boards. Four boards have equal numbers of men and women, although three of those are related investment funds run by the same people. Only two boards have more women than men.

In addition to the 60 firms that have all-male boards, another 52 have only one woman on their board. That's more than 70 per cent of boards that have very low female representation. No matter which way the numbers are juggled about, women are very much in the minority in the top-level management of NZX listed firms.

Without even considering equity issues, this is bad news for New Zealand firms. Research tells us firms do better when there is more diversity in their leadership and management. That seems to be because people from different backgrounds bring different perspectives to issues, encouraging people to test their ideas and arguments against a variety of competing alternatives. Proposals that have withstood scrutiny from a range of perspectives are more likely to succeed.

Having at least one woman on a board increases diversity, as does having people from different ethnic and national backgrounds. However, it seems to be important to have more than just one "different" person.

Research also tells us that contrary to urban myth, women support each other in discussions, ensuring each other's voices are recognised and heard. There's a famous Punch cartoon with a chairman saying, "That's an excellent suggestion, Miss Triggs. Perhaps one of the men here would like to make it." Having more than one woman on a board makes it more likely that Miss Triggs and her peers are given credit for their ideas.

Fortunately, there's a broad range of work to encourage firms to diversity their governance. NZX requires listed firms to report the gender diversity of their boards. Firms are not required to adopt a diversity policy but they are encouraged to do so. This simple disclosure requirement means that boards have to at least consider issues of diversity.

The New Institute of Directors has a Future Directors programme. Encouraging women to participate in this programme will enhance their chances of obtaining a board position.

The Ministry for Women runs a nominations service to facilitate the appointment of women to state sector boards and committees. This service could be expanded to private sector companies as well. The objective would be to encourage women to take that next step up, and to provide a resource for companies to find excellent women for board positions.

It may seem absurd to compare Peters, Davids and Marks with all women. Yet when we do, it perfectly illustrates how corporate New Zealand excludes women.

All it takes is a bit more thought and effort, to pause before leaping to the safe choices that are always made. Then, in 10 years, there will be many more Susans, Rebeccas and Sarahs appearing in the lists of directors.

CEOs of all NZX-listed entities

Given name	Number
David	13
Mark	13
Christopher / Chris	7
Michael	7
Women of any name	5
Graeme or Graham	5
John	5

Chairmen of all NZX-listed firms

Given name	Number
Peter	11
David	8
John	7
Christopher / Chris	6
Women of any name	5
Michael	5

Data was sourced from annual reports presented to NZX during the year from 1 April 2014 to 31 March 2015.

BUSINESS

Can Auckland's North Shore be the next Silicon Valley?

Industry leaders see the North becoming a magnet for talent and innovation.

Barcelona, Spain. Boston, Massachusetts. Auckland, New Zealand? The creation of innovation districts is an urban planning trend that has emerged in cities across the globe – and many are asking if Auckland's North Shore could be next. The notion has been bubbling away for some time but there's currently a groundswell of activity to really get the idea off the ground.

Massey University, industry leaders and Auckland Council have partnered to undertake a research project dubbed Grow North. This project aims to identify the obstacles and opportunities in developing an innovation district in Auckland's north.

What might this look like? At this stage, this is an open question, but after interviewing a broad range of interested stakeholders, several key features have been identified. The first is the recognition that an innovation ecosystem already exists, both virtually and physically. There are hotspots of collaboration and co-working peppered throughout the area north of the Harbour Bridge – and these must be fostered rather than shut out of a newly-established ecosystem.

The vision that is emerging is not of a single location, but of a series of closely connected sites. Albany, Takapuna and Orewa are the most commonly suggested centres, given the activity already taking place in these places. Each will develop its own culture and focus – whether it's tech geeks or social innovators – but all three would need to collaborate to create a single regional identity.

There must be an identifiable and meaningful brand that people can coalesce around. The district needs a heart and good transport connections are a must, between the three locations but also linking Auckland's north with the central city and Northland. A free light-rail link seems the most obvious answer so many locations are strongly networked together.

Another crucial factor is ensuring the local community is included in the vision. Those who might not automatically consider themselves part of the "innovation ecosystem" must still feel welcome. A public innovation centre must be part of any development: a place to hold workshops and lectures, where school groups can visit and art installations can be displayed.

These areas need to incorporate mixed development sites so they can become hip, vibrant and diverse. They need robust infrastructure, from high-speed broadband to public and commercial spaces for co-working and shared services. Buildings must contain a mix of shops, restaurants, offices and residential apartments to provide spaces where people live, work and hang out.

We often hear that regions want to become the "next Silicon Valley" but that is impossible. The growth of industries, occupational trends and the values that support them are created by history and culture, shaped from the identity and geography of the place itself. We must not forget, too, that Silicon Valley is not enviable in all ways. It struggles with a growing wage gap and the glass ceiling for women and ethnic minorities, not to mention overwork, the stress of competition and traffic congestion.

While cities often see innovation districts as a model to stimulate economic growth, as a concept innovation is not limited to the realm of for-profit business development. An innovation district has the ability to address issues of social justice and inequality, education and working "smarter". It should help to identify and solve problems, including the "wicked" and intractable problems of our times.

The most successful innovation districts are a mash-up of diverse sectors, where organisations are open with their communication and collaboration. Our diversity is also our best source of innovation. We already have the advantage of this country's biculturalism and, increasingly, multiculturalism and multilingualism. Immigration, particularly of highly skilled and educated migrants, often leads to increased innovation and patents.

Rebecca Gill
Innovation and entrepreneurship lecturer at the Massey Business School. She is also lead researcher for the Grow North project

Universities also have an important role and the North Shore has several campuses that can contribute by developing and attracting talent. We teach creative and critical thinking, the history of ideas and collaborative work. But education in an innovation ecosystem will focus these modes of thinking on problem-solving and disruption of the status quo, bolstered by new courses in coding, project management and innovative leadership.

Supporting this will be innovative lab space on college and university campuses that draw together public, industry and government interests to work across disciplines. I see on-campus student hatcheries that link to business incubators, accelerators and co-working spaces in the community.

Auckland's north already has many prerequisites for an innovation district, including universities, incubators like the ecentre and supportive local government. It seems to me the right mindset and culture also exists and the region is beginning to embrace its own, distinct identity.

This is a 10-year plan, but one that is within reach with the right support. With the necessary infrastructure and a meaningful brand, the region should have no trouble becoming a magnet for talent and innovation. The economic and social benefits flow from there, including new ventures, additional jobs, wage increases, and better living spaces and quality of life. ●

MIGRATION

The immigration wave continues

The numbers of people coming to New Zealand, and where they are coming from, is significantly altering the face of the country.

The number of international students coming here to study continues to increase. Many return and become permanent settlers.

Paul Spoonley
Pro Vice-Chancellor of the College of Humanities and Social Sciences at Massey University

Immigration continues to reshape New Zealand, more so now than in any other time in the modern history of our country. In the 12 months to August 2015, nearly 118,000 permanent and long-term arrivals landed in the country. This is an all-time high.

It is underlined by the fact the net migration gain was 60,000 for the same period and climbing. Only a couple of years ago, the forecast was for a net gain of 35,000 – which was thought outstanding at the time. But in 2014 and 2015, records have been broken and reset.

Some of these figures do need to be unpacked. "Permanent and long-term" includes anyone staying for more than 12 months, so there is a large group of international students who will not stay in the country more than the length of their study period. And there is an even larger group of New Zealand – and Australian – citizens who arrived (35,200 in the last 12 months).

So what has produced this spike?

The first is that we are seeing an upswing after the Global Financial Crises (GFC) when the numbers arriving softened (down to 83,000) while the numbers departing increased significantly (nearly 54,000 in one year heading to Australia). So some declined to move, even if they had been given approval, during a time of economic uncertainty. And then New Zealand experienced economic and labour market growth downstream of the GFC, especially in relation to Australia.

The net gains/losses with Australia have gone from a loss of 40,000 in 2012 to a net gain in the last twelve months of 5500. There remains a constant flow across the Tasman but for the first time since the early 90s, it is in New Zealand's favour.

Secondly, there has been a year-on-year increase in the numbers coming to study, with student visas up by 6400 in the last year, and with about half of Chinese and three-quarters of Indian migrants coming on a study visa.

Many will not stay permanently and as a result will have a different effect on demand and consumption spending in New Zealand. But it is also interesting that these onshore talent pools increasingly provide those who will settle long-term. Almost four out of five who become permanent settlers have spent time working, studying or visiting New Zealand.

The current levels of immigration put New Zealand at the very top of the OECD in terms of immigration per capita. The numbers post-GFC are very high.

It is not just the numbers that count – there is also the question of where they are coming from. In terms of net gains, the top four arrival groups (in order) are from India, China, the Philippines and the United Kingdom. There are three times more Indians arriving than those from the UK – which signals what is now an ongoing shift in terms of the origins of immigrants to New Zealand.

Statistics NZ has just released its long-term (2038) ethnic projections, and the impacts of immigration can be seen clearly in a future New Zealand. The fastest growing communities will be Asian as immigration levels drive growth. But not everywhere.

Auckland is still the destination city for most immigrants, (Canterbury has a significant inflow of immigrants as part of the rebuild, but it is still only a quarter of the numbers going to Auckland). And it is the destination city for Asian immigrants. Two-thirds of New Zealand's Asian communities live in Auckland, with three-quarters of them having been born in another country.

Statistics NZ anticipates this growth will result in a third of all Aucklanders being Asian by the 2030s (up from the quarter who self-identify as Asian now).

For the moment, the high levels of immigration and the significant numbers arriving from Asia impact disproportionately on Auckland. And the various local board populations show that not only are those of European descent likely to be a majority-minority in a growing number of areas, there are some (Whau, Puketapapa, Howick) where Asian communities will be dominant soon, if they aren't already.

The last few years have seen a remarkable increase in the numbers arriving as permanent immigrants to New Zealand, but they also confirm the different cultural and linguistic mix of these immigrants and the impact they are having on our largest city.

It is difficult to know whether this spike will continue but it has already set a very different path for New Zealand – and Auckland. The latter is now a super-diverse city with extensive people-to-people links with Asia. ●

TECHNOLOGY

Data science: Making use of a valuable by-product

We are at a point in our technology-saturated society where data is a by-product of almost every day-to-day activity we engage in.

Data science underpins much of our modern life, from book recommendations to scientific breakthroughs.

The enormous amounts of available data have become the modern-day goldmines out of which valuable insights, scientific discoveries and actionable knowledge can be extracted – insights that can benefit society as a whole or deliver increased profit and competitive advantage to businesses. This rapidly developing field of 'data science' is transforming much of our daily lives and there is a growing demand for data scientists.

By virtue of being a blend between computer science, modelling and statistics, data science is the craft that transforms data into knowledge and action. In contrast to traditional business intelligence practices which are typically backward-looking, data science is instead focused on generating actionable intelligence based on historical data by identifying patterns and predicting future outcomes.

It is the wizardry of data science that powers your favourite book recommendation engine and your mobile phone's speech recognition system. Every time your phone or camera detects faces in images or Google anticipates your search query, it is the predictive power of data science at work.

Our email inboxes are conveniently protected by spam and our credit cards periodically cease to work because a fraudulent transaction has been detected, all thanks to actionable knowledge produced by data science algorithms and the underlying programming. Many of our medicines have been developed using data science and computational chemistry, while our investment portfolios are increasingly likely to be algorithmically traded by systems using predictive modelling.

New Zealand faces some big challenges and data science promises to contribute innovative solutions. Our health system is under increasing budgetary pressure and continuously under threat of cuts where the intention is to achieve greater efficiency without affecting the quality of patient care. Improving diagnostic methods, targeted treatment and ultimately improved disease prevention are some of the crucial components to realising both better efficiency and quality in the healthcare system – and data science is at the forefront of research into this.

Ray Geor
Pro Vice-Chancellor of the College of Sciences

Teo Susnjak
Lecturer in IT and Data Science major leader at Massey University

At Vanderbilt University Medical Centre in Nashville, doctors receive real-time alerts that guide selection of drug therapies based on complex analysis of treatment response data from thousands of other patients with similar clinical and/or genetic traits. This approach promises to realise unprecedented improvements in patient outcomes together with savings in healthcare costs. Using data-driven analysis from extensive patient databases, current medical literature as well as mobile monitoring and patients' real-life experiences with drugs, doctors at Stanford Medicine are moving towards the study into very early diagnosis of diseases before symptoms even develop.

Burglary and theft-related crime make up 45 per cent of offences in New Zealand. In order to tackle such crimes, the Los Angeles Police Department turned to data science and software whose underlying algorithms were originally used to predict earthquake aftershocks. By modifying the software to process historical incidents of crime as well as a continuous feed of real-time data on current criminal events, they devised a system capable of predicting where and when future crimes would occur. By dispatching officers to the predicted locations at a given time, this type of crime reduced significantly.

This may sound like it belongs in the realm of science fiction and Hollywood blockbusters, but the astonishing success of this predictive system has now resulted in its roll-out in numerous other US jurisdictions and there is strong interest internationally. Meanwhile in the UK, Durham Constabulary is deploying a forecasting algorithm designed to predict the likelihood that a suspected criminal will commit another crime based on a number of demographic, personal and offence history inputs.

Just as all sectors of our society stand to gain immensely from applications of data science, the success and failure of businesses is also increasingly becoming dependent on their ability to drive more value out of their data. In today's global market, businesses need to do more than just meet the challenges before them, but instead must be able to accurately anticipate the future.

New Zealand businesses are particularly struggling with how to transform data into intelligence which can be deployed and used for a competitive advantage. Great opportunities lie ahead for New Zealand businesses, especially in the areas of analysis of the purchasing behaviour of customers as well as a greater leverage of their data from customer loyalty programmes.

As technology drives change at an unprecedented speed for the world's workforce, the information sector is one of the few secure jobs of the future. If you are looking for a career change, consider data science, dubbed by the Harvard Business Review as "the sexiest job of the 21st century". ●

LIFE IN THE WORLD OF THE PHYSICAL WEB

What will happen in our everyday lives as just about everything we use becomes connected to everything else?

Hans Guesgen
Holder of the Chair in Computer Science at Massey University's School of Engineering and Advanced Technology

The internet has become an integral part of our lives. Whether for shopping online or making a holiday booking, socialising with our friends through social media, or just finding information about areas we are interested in, there is hardly a day we don't connect to it.

How did this happen? The internet only achieved critical mass once an easy-to-use, standard way of accessing it had been created: the worldwide web. All you need is an internet browser and you can go surfing wherever you like. So, what will be the next milestone in the development of the internet?

Currently, most internet interactions are initiated by us – something that is not likely to be the case in the future. The number of 'things' that interact with the internet is steadily increasing.

It is no longer surprising that washing machines are now available with internet connectivity, or that your power meter feeds back information to your energy provider which is then available for you online. In the future, the 'internet of things' will become more and more ubiquitous. Devices will initiate their own communication and will intelligently interact with other devices.

For example, the embedded computing device in your washing machine might communicate with the power meter to check current electricity prices with the aim of starting the wash cycle when prices are low. Or your heat pump might check your geolocation data to see whether you are approaching home so it can switch itself on to make your home cosy for your arrival.

What role do humans play in the internet of things? Device creators usually enable people to communicate with their smart devices, often by offering an app for their smart phones. This is convenient, especially when the app is free – and when you are only dealing with a small number of devices.

But what happens if most of your household appliances become part of the internet of things? An app for your washing machine, an app for your heat pump, one for your fridge, and how about small appliances like toasters, water kettles, lights and more? Then add all the devices outside your home that are of interest when you are in their proximity, like parking meters and vending machines. Imagine how many apps you will have to install on your smartphone.

The prospect of app inflation clouds the future of the internet of things. But there is a silver lining – the 'web of things', or the 'physical web', as Google calls it. Instead of individual apps, devices use a general purpose browser. You can download this browser, called Physical Web, from Google's app store even though it is not yet an official Google product but rather an early-stage experimental project.

The technology behind it is UriBeacon, an open specification to connect devices via Bluetooth low-power beacons to your smart phone. The beacons broadcast short URIs, or uniform resource identifiers. As Tim Berners-Lee, the father of the web, puts it: "A uniform resource identifier is a compact sequence of characters that identifies an abstract or physical resource." If you are in proximity of an UriBeacon, the browser pulls in the URI broadcast of the device and shows it in a similar way as a Google search result, which you can then tap to interact with the device.

So no more flood of apps on your smartphone but one unified app for the internet of things. While there will be billions of devices on the internet of things, Bluetooth low-power beacons have a limited range so only nearby devices will be picked up. For instance, you will only see the menu of the restaurant you are looking at, rather than the menus of all restaurants in town. Or you will only be able to transfer money to the parking meter for your car park, rather than any other one.

As the beacons just broadcast to you and don't monitor you, they are not a threat to your privacy as such. But in the same way that malicious websites can use spam and phishing methods to collect private information today, reacting to rogue beacons in the future could allow access to the personal data stored in your smart phone.

So if the web of things becomes a reality – and there is every chance that this will happen as UriBeacons are cheap and can connect to most modern smartphones – what will be next? Once regular web browsers are able to deal with beacons, their broadcasts can be incorporated into Google search results, providing you with geospecific information. This is when the web of things meets the web as we know it today. ●

For more content go to http://futurenz.massey.ac.nz and nzherald.co.nz/go/futurenz

POLITICS

UN Security Council: One year to go

Nearly a year into its tenure on the United Nations Security Council, including as President of the Security Council in July, it is timely to consider what impact New Zealand is having at the United Nations.

Anna Powles
Senior lecturer at Massey University's Centre for Defence and Security Studies

New Zealand's Foreign Minister Murray McCully has been outspoken on the Securrity Council, but to little effect.

Are New Zealand's actions on the Security Council measuring up to its highly successful campaign message, which resonated amongst UN member states? New Zealand pitched itself as a trusted and independent advocate for non-permanent member states seeking a voice at the Security Council, with a proven track record of a human rights-based approach and a commitment to negotiation, dialogue and multilateralism.

At first glance, New Zealand has effectively translated its campaign message into a clear and consistent strategy on the Security Council. But as UN member states pledged increased troop personnel and assets at the Leaders' Peacekeeping Summit hosted by President Barrack Obama in New York in September, we need to ask the question whether clear and consistent statements are enough? Foreign Minister Murray McCully's "stinging criticisms" of the Security Council's failure to act over Syria make good headlines back home but when are we going to see New Zealand translate its Security Council doctrine into practical action? What new ideas has New Zealand brought to the table?

According to the latest UN rankings (August 2015) on member state contributions, New Zealand ranks 100th with a contribution of 11 personnel deployed to either the UN Mission in the Republic of South Sudan (UNMISS) or the United Nations Truce Supervision Organization (UNTSO) in Jerusalem. To put New Zealand's contribution in perspective, we equal with the Republic of Moldova and below Jamaica with 13 personnel.

The question of whether New Zealand should increase its peacekeeping contribution is not new. It re-emerged during New Zealand's most recent campaign for the Security Council seat and as the electronic leaderboard at the Leaders' Peacekeeping Summit ticked over with pledges from UN member states promising increased contributions of troops, police, and assets, it has emerged again.

There are strong arguments for and against increasing personnel contributions but it isn't all about the numbers and nor is it as simplistic as "having a dog in the fight" now that we have a seat on the Security Council. New Zealand does have a stake in international security but it remains worthwhile to ask if New Zealand is contributing personnel in the most effective ways to peace operations. What value does inserting military observers into a few select missions have to the mission itself, to the UN more broadly, and, of course, to New Zealand? Does New Zealand, in fact, have a clear strategy for contributing personnel to UN peacekeeping operations?

Measuring New Zealand's record on the Security Council means evaluating its contributions in terms of the sustainability of its impact. That means gauging how much influence a small state like New Zealand can have over the international security issues dominating the Security Council in 2015-2016. Arguably, it is too early to do so now but there have been some interim analyses.

In June, Amnesty International released a report card on New Zealand's performance on the Security Council and gave New Zealand an A- for its commitment to making the UN Security Council more effective. The rest of New Zealand's report card went downhill from there with a B- for working to strengthen the human rights components of UN peace operations; a C+ for championing human rights and working to address Syria's humanitarian crisis; and a C for championing women's rights and their role in peace-making.

Amnesty was especially critical of New Zealand's failure to organise the bi-annual Security Council debate on protecting civilians in conflict during its presidency. A month later, a joint NGO letter was submitted to New Zealand Foreign Minister Murray McCully on the eve of the open debate on peace and security challenges to Small Island Developing States (SIDS) hosted by New Zealand in the Security Council in July. It called for greater attention to women, peace and security issues in the Pacific.

Meanwhile, back in the Pacific, climate change is the critical security issue in the neighbourhood. At the August Pacific Islands Forum meeting in Port Moresby, New Zealand – and Australia – proactively worked against Pacific Island member states' efforts to achieve a climate policy accord before the COP21 talks in Paris. Small island states wanted emission reductions that would keep global temperatures within 1.5 degrees over pre-industrial levels. These are the same Pacific Island nations that New Zealand lobbied for support for its seat on the Security Council. Is this really the kind of legacy New Zealand wants to leave? ●

POLITICS

Where to next, Auckland?

Next year Auckland will elect a new mayor, council and local boards. What should be written into their job descriptions?

Grant Duncan
Public policy lecturer in Massey University's School of People, Environment and Planning

What's the worst thing that could happen to Auckland? Compared to a volcanic eruption under the Harbour Bridge, the prospect of Aucklanders electing an ineffective mayor at the 2016 local body elections is hardly the stuff of nightmares.

There is already a selection of possible candidates widely discussed in the media, though it's too early to say for sure who the frontrunners are going to be. Other than Penny Hulse, the present deputy mayor, those touted as potential candidates have a distinctly white male look. So, what happened to the city's growing "diversity"?

Does it really matter who wins anyway? The mayor, and the elected governing body as a whole, arguably have little power when weighed against the inertia of a large bureaucracy and prescriptive laws. And the sheer size and relative autonomy of council-controlled organisations that manage transport, water and most of the commercially significant assets mean there is less democratic control of Auckland's future than ratepayers may imagine.

Auckland Council also has limited influence over central government, even though decisions made in Wellington – for example, how many migrants get residency here – will significantly affect the future of the city. And the council can plan sophisticated urban spaces but, if developers don't see those designs as economically viable, they won't get built. A visionary mayor could easily become a lone voice that no one is listening to.

So, regardless of whether you prefer a centre-left or centre-right mayor, or someone more radical, when you cast your vote next year, ask yourself if your chosen candidate can really be effective. The mayor needs to lead a team of outspoken councillors and a powerful chief executive, while balancing and influencing external and internal political forces that may be beyond his or her control. As the leader of a large and populous urban and rural domain, that person must speak for the whole 'city', in all its diversity, and to articulate an ambitious, but realisable, vision for its future.

Mayor Len Brown has set the pace so far. He didn't cave in to political pressure when outed for having an affair but these revelations have tainted the mayoralty itself in many people's eyes. The next mayor will need to re-establish public faith in the office.

Transparency around the conduct of the mayor's office, as well as the mayor's professional behaviour, will have to be uppermost in his or her mind. Furthermore, he or she will need to consolidate the new unified Auckland governance model that was inaugurated in 2010.

Auckland is bedding in a unitary plan and a unified budget. Politically, these processes have made Auckland's problems more visible and the arguments around them louder. But the unification of Auckland governance is necessary if we are to grapple with those problems coherently.

In short, Auckland is going up a gear. The next mayor and the elected councillors and local board members will all share responsibility for dealing openly with the differing needs and values of Aucklanders, and the differing visions for how the city should be planned and developed.

Suburban sprawl or intensification; motorways or trains; eighteen-hole golf courses or parks and houses? As the city grows, the debates won't get any easier. Hence we need civic leaders who can engage with the people and understand complex problems and the consequences of different policy solutions.

Auckland's success is essential to New Zealand's success, and Auckland is the destination for most of the skilled migrants that New Zealand attracts. Auckland needs a mayor who includes and does not alienate diverse audiences, who can articulate a realistic, but exciting, vision for the city, and who can bring a large number of often fractious and hard-nosed people to the table and get them talking positively.

There is one last thing to consider. No one asks for higher rates, but be wary of those who talk simply of cutting them. For every dollar cut, they should give an account of what will be lost or foregone from the council's public services. Remember, there's always a long-term cost incurred in not doing something. ●

Next year Auckland needs to appoint mayor with vision who is able to re-establish public faith in the office.

SPORT

Will we bring home the gold from Rio?

A huge investment in time, expertise and money has the NZ team aiming for a bountiful medal tally at the 2016 Rio Olympics.

The London 2012 Olympics were hailed as New Zealand's most successful with 13 medals – six gold, two silver and five bronze. The medal tally equalled the performance in Seoul in 1988. Eight golds were won in Los Angeles in 1984; however these Olympics were boycotted by the Eastern Bloc countries.

High Performance Sport NZ funding for London provided a lucrative return from key sports, with the exception of swimming, which failed to win a medal. New Zealand rowers topped the podium with five medals in total (three gold and two bronze). Valerie Adams and Lisa Carrington won gold in their events, while cyclists (silver and bronze) and the equestrian team (bronze) also brought home some hardware. Less anticipated medals came in sailing (gold and silver).

So how will New Zealand perform in Rio de Janeiro next year? The modest medal target is set at 14 for the Olympics and eight to 12 gold medals for the Paralympics with funding decisions made accordingly. Most of the funding (nearly 40 per cent of the $127,990 million will have been spent by the time the Rio Olympics begin) is allocated to Tier 1 sports: rowing, cycling and yachting – all of which delivered in London.

Given its underperformance in London, funding for swimming was subsequently cut, so it will be important for swimmers such as Lauren Boyle, who has already qualified for Rio, to have strong performances. Paralympic swimming is on a high with Sophie Pascoe and Mary Fisher expected to have successful Games.

With less than a year until the opening ceremonies, teams are being selected and athletes are working hard to secure their inclusion. New to the 2016 Olympic programme is sevens rugby, where New Zealand is expected to win medals in both the women's and men's events. Likewise, Lydia Ko's excellent performances in 2015 are an indication that she will be a very strong contender for gold in golf.

The rowers are aiming to be as good, or better, than they were in London, if the recent World Championships in Aiguebelette, France are anything to go by. Medal hopefuls for rowing are the men's and women's eights who have both qualified for Rio; a debut for the women and a return for the men for the first time since 1984. More medals are likely among our cyclists and from canoeist Lisa Carrington.

Shot putter Valerie Adams's form is questionable after undergoing elbow and shoulder surgeries at the end of 2014. She is seeking to defend her Olympic champion title. However, men's shot putter Tom Walsh has been performing strongly in Europe's Diamond League, where he recently won his first event beating the three medallists from August's IAAF World Championships in Beijing, thus proving he is a medal contender.

Sarah Leberman

Sarah Gee

Trish Bradbury

Athlete Nick Willis, a 1500m specialist and 2008 Olympic silver medallist, recently won the Fifth Ave Mile race in New York, signalling a strong start to his season. The Women's Black Sticks hockey team, who narrowly missed out on a medal in London, will be looking for a medal and boxers David Nyika and Alexis Prichard and weightlifter Richie Patterson are also possibilities. If Andrew Nicholson can recover from being injured earlier this year, he must also be a serious contender, given that he was a member of the eventing team to win bronze in London.

The challenge, as always, will be producing medal-winning performances in the huge spectacle that is the Olympic Games.

Government funding assists teams and athletes with their preparation for the Olympics, but what matters most is the performance on the day, which is one of the things that makes sport so exciting. New Zealand is recognised and celebrated for being a small sporting nation that punches above its weight on the international stage and we expect Rio to be no different.

Professor Sarah Leberman is Deputy Pro Vice-Chancellor of the Massey Business School, Dr Sarah Gee is a senior lecturer in the School of Sport and Exercise and Dr Trish Bradbury is a senior lecturer in the School of Management. All are involved in delivering at Massey University's sport management programme.

Kayaker Lisa Carrington has set her sights on an Olympic double gold medal in Rio next year.

Road to riches or rings of ruin?

Nations pour billions into sporting spectaculars such as the Olympics and World Cup finals. What is the pay-off for the hosts?

Sam Richardson
Lecturer in the School of Economics and Finance at Massey University

Brazil has poured billions into infrastructure for the 2014 FIFA World Cup finals and the 2016 Olympic Games with little discernible benefit to the nation.

London's 2012 Olympics "legacy facilities" are under-utilised, and Beijing's 2008 Olympics' iconic Birds Nest is on the tourist circuit and hosts only a few events. South Africa's 2010 FIFA World Cup facilities are also largely unused five years after hosting the biggest show in football. Have sporting mega-events like the Olympic Games become too expensive for any nation to contemplate?

A quick glance at estimated cost figures for recent mega-events makes for eye-popping viewing. Athens 2004 came in at US$16 billion, Beijing 2008 came in at US$40 billion, London 2012 at US$15 billion while Sochi's 2014 Winter Olympics cost a whopping US$51 billion. It is little wonder that countries are starting to baulk at the price tag. The bidding process for the Winter Olympics in 2022 saw four of the six candidate cities pulling out due to reluctance on the part of either the government or the population to foot the bill.

What, then, is the pay-off for host nations? Economically, the big events often fail to make a return. Of the six Summer Olympic Games since 1988, only two (the United States in 1996 and the United Kingdom in 2012) experienced higher average economic growth in the four years post-Olympics than the four years preceding the event. Only one of the last six Winter Olympic host countries (Canada in 2010) experienced higher growth after the Olympics than before.

The buzzword doing the rounds in recent Games has been "legacy". But rather than leaving a beneficial legacy such as that attributed to Barcelona, the legacy of recent Olympics has been anything but beneficial.

The Olympic Games in Athens has been blamed for some of Greece's economic woes — with unused facilities creating a cost for the taxpayer to maintain. The situation is similar in Beijing. The Birds Nest stadium costs an estimated US$11 million every year to maintain — and doesn't have a major tenant.

So why do countries continue to line up in spite of the fact that hosting is costly and the legacy is shrouded in doubt?

In more recent times, the Games have been used as a catalyst to turbocharge development of run-down and less desirable parts of cities with less opposition than what might normally be encountered in the absence of the Games. The appeal of the Games as an advertisement for the city and country is strong. There are also hopes that the Games will bring an economic boost with an influx of spectators spending money which, in turn, generates more jobs and incomes.

Yet all of these hopes should come with a warning label. Games-related development does not always work unless it is part of a wider plan. The Games can have a negative effect if things go wrong, and the evidence shows that tourism isn't stimulated. Australia suffered a four-year decline in tourist numbers after Sydney 2000, while New Zealand enjoyed a 30 per cent increase in the same period.

International Olympic Committee (IOC) president Thomas Bach visited New Zealand in May as part of a global tour to drum up support as an increasing number of countries view hosting the Games as a poisoned chalice. The IOC wants more candidate cities but if it wants greater buy-in it must champion sustainable economic management of the Games. The IOC's rationale is simple: the greater the number of bidders, the higher the chances of the successful city over-paying for the privilege.

In this context, a 2014 pre-feasibility report compiled by Queenstown's Bruce McGechan, which recommended that Queenstown and Auckland bid for the 2026 Winter Olympics, needs to be treated with caution. Ultimately, cities and countries need to carefully consider the benefits and costs of hosting.

Mega-events like the Games benefit only a few in the host country, while the costs impact on everyone. Governments owe it to their constituency to perform due diligence on the actual impact of hosting the event. That includes being as transparent as possible regarding the true costs of hosting. Greater transparency will ensure cities and countries realise exactly what they're putting in — and getting out. ●

EDUCATION

Badging – a new way to personalise learning

Digital badging challenges traditional approaches to education and offers innovative alternatives to credit skills and knowledge outside the formal curriculum.

A digital badge is a new way of displaying an achievement across many different contexts.

Mandia Mentis
Associate Professor at Massey University's Institute of Education

Digital badging is an emerging education trend that offers a fluid, informal and flexible way for people to learn in different contexts and be recognised for the knowledge and skills they've acquired. As the name suggests, it is a contemporary, online version of a Scout or Girl Guide badge earned for a specific skill. A digital badge is customised, open source and available to everyone.

A "badge" is a way of displaying and verifying an achievement, ability, skill or interest that can be achieved in a variety of learning environments. It could be a formal academic award or the demonstration of abilities and "soft skills" such as leadership, communication, collaboration and organisational skills.

Badges are small digital images of pictures, symbols or words that signify achievement. The image is hyperlinked to information about who issued the badge, when, and the criteria of achievement. The receiver can display their badges on their personal websites, blogs, or digital CVs, and the hyperlink allows anyone to check the credentials of the badge.

What impact might badging have on traditional learning methods and institutions? We have identified three areas where badges challenges the status quo and offer innovative teaching and learning opportunities.

BADGING FOR FORMAL AND NON-FORMAL ACHIEVEMENT

Skills, knowledge and competencies can be acquired across many different contexts: in formal classrooms, on the sports field, through cultural events, in the workplace, through hobbies and clubs. Badging is a way to acknowledge learning that is authentic, networked and made of many parts. It connects formal and non-formal achievements, enabling a learner to showcase individual strengths and interests across a range of areas.

Badges can be used to evidence: achievement in a formal assessment, an endorsement from a peer, or recognition of soft skills. These can provide a more detailed and personalised learner profile.

Massey's Institute of Education is piloting the use of formal and informal use of badging in professional programmes. Badges are awarded as learners progress through online courses and as credits for completion. Achievements outside of formal course work as well as interaction in online learning are badged as evidence of meeting core competencies.

BADGING TO 'RE-BUNDLE' TRADITIONAL COURSES

Contemporary teaching and learning is flexible and distributed with free access to information anytime, anywhere. Open online courses are easily accessible and badging is a mechanism to credit achievement.

Badging offers potential for traditional programmes to be designed in different ways. "Unbundling" a course into modules enables learners to "re-bundle" the modules most relevant to them so they can design their own learning pathway. Badging each module enables learners to either step through a prescribed course at their own pace or to mix modules.

BADGING FOR ONLINE IDENTITY AS A LIFE-LONG LEARNER

Learning is not just about what you know – it's increasingly becoming more about who you are and where you belong. Badging can be used to develop an identity as a life-long learner connected to a field of practice.

Displaying badges of capabilities as part of an online identity enables learners to present a more complete picture of themselves to various audiences, including potential employers, mentors, peers and collaborators. This online identity, showcased through badges in a personal or professional website, blog or portfolio enables networking with other professionals and learners.

Learners can develop a professional online portfolio with badged achievements. Portfolios showcase evidence of a professional identity as they document ongoing professional learning, continuing competence, and provide a vehicle to network with other professionals in practice.

Digital badging challenges traditional approaches and offers innovative alternatives to credit skills and knowledge outside the formal curriculum. For some learners, badging is motivating and fun, helps to track progress, validates soft skills, recognises that learning is flexible and open and that achievement occurs across contexts. Many say it's the next revolution in learning. ●

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