10 November, 2016

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Forward to the future

Shayne Currie
Managing Editor, NZME

Be change ready. Be flexible. Adapt and adopt. Or falter.

Technology continues to change the way we work, live and play – and nowhere is that more evident or exciting than in the workspaces and classrooms of New Zealand. That pace of change has only accelerated in the past 12 months.

A key theme in today's Future New Zealand magazine – the NZ Herald's annual collaboration with Massey University – considers the impact and upheaval of that change on our daily lives.

As we study our cyber crystal ball, some key questions arise. How insulated are we from data hacks and attacks? What can these cyber criminals do with our personal and private information?

> What can these cyber criminals do with our personal and private information?

How can we better protect our information?

A recent NZ Herald survey of business CEOs placed cyber security at the top of their concerns. Today's magazine probes this issue forcefully, raising awareness around specific areas of concern and sparking more debate around potential solutions. Dr Andrew Colarik argues that we need far greater debate and discussion around who owns and controls our information, to ensure we don't become trampled in our own digital footprint.

More positively, how is technology change making our lives even easier? Tim Bentley writes of how workers and workplaces need to be far more flexible and agile to meet future needs – not necessarily an easy goal considering the ageing population and workforce.

Here at NZME and the NZ Herald, we're experiencing firsthand some interesting social changes in the workplace. In Auckland, we're witnessing something of a minor exodus, with three or four senior journalists departing for the regions in coming months. Yet, we're not losing their skills: technology such as high-fibre, ultra-fast broadband allows them to continue to write and report great stories, and design beautiful interactive graphics and front pages from an office space in Kerikeri or rural Bay of Plenty.

That's the kind of flexibility Kiwi employers need to embrace to sustain themselves. Today's magazine offers yet another fascinating insight into the shape and direction of New Zealand's future. It's a wonderful launch pad for more discussion and debate. Join us, then, as we look into that cyber crystal ball.

Learning to live with uncertainty

Steve Maharey
Vice Chancellor, Massey University

Do you feel secure? Many people do not. They look around them and see the UK leaving Europe, China challenging the United States, terrorism, cyber attacks, climate change, the rising cost of housing, inequality, new technology taking over jobs – and they wonder how they will cope.

Future NZ 2016 is all about security. This is very much the subject of the times. It is behind so much of the political uncertainty in the world. Mainstream parties do not seem able to come up with answers to the questions people are asking. More radical parties from the left and right are being listened to and are gaining considerable support.

The authors of the articles published here are not taking sides, but they are providing food for thought. There are no easy answers to the complex questions we all face. But we can make a start by being better informed about what is going on.

> What is important is that our search for security does not make us defensive or insular. Rather, we need to find ways to live with complexity and uncertainty that will allow us to thrive. What is happening in the world can be as much a source of opportunity as it can be a challenge

This process will be helped not only by *Future NZ*, the magazine, but also Massey University's Future NZ Forums, which will be held in Auckland and Wellington and focus on security issues. This is the fourth year the forums have been held and in the past we have looked at megatrends, the rise of China, changes in population and the food revolution.

The focus on security this year acknowledges that security is becoming central to the way we organise our society. What is important is that our search for security does not make us defensive or insular. Rather, we need to find ways to live with complexity and uncertainty that will allow us to thrive. What is happening in the world can be as much a source of opportunity as it can be a challenge.

The aim of Future NZ – both the magazine and the events – is to help us take a positive look at what lies in front of us.

I hope you find the content of this magazine thought-provoking and it helps you to consider the future New Zealand in which you want to live.

FUTURE NZ Editor: **Sidah Russell, Massey University** Art Director: **Xanthe Williams, NZME** Project Manager: **Darrell Denney, NZME**

SECURITY

WHEN YOUR OWN DATA IS USED AGAINST YOU

What would happen if our competitors decided to disrupt our supply chains in order dominate our markets for themselves? Be very scared

Vigilance is needed to ensure privacy and security in the digital space.

So much of our livelihood is now connected to the digital space. Our primary industries, which are the backbone of the economy, globally compete using information and communications technologies (ICT). The buying, selling and distribution of goods and services are enabled with the 1s and 0s of the global information infrastructure. With these technologies, supply chains are fulfilled and relationships maintained.

The immense growth of the internet has given us access to information and markets that previously would have taken huge logistics to establish. It's easy to see the advantages of this new reality. But, all too often, we see only the benefits of change and not the consequences until it's too late.

New Zealand has embraced the internet. We are a small country so it is no small feat that we have created a $200b economy with a population of around 4.5m. In relative terms, that is the size of Apple Inc. In today's competitive market place, they face fierce global competition, and so do we.

Dr Andrew Colarik
Senior lecturer with Massey University's Centre for Defence and Security Studies

Now imagine what the rest of the world sees: a small group of people with a very large, yummy pie. Can they come and take it away? Could we stop them if they tried? Truth be told, professing to be small may invite more threats, not less, in this digital landscape.

This is the new reality: there is a direct correlation between gross domestic product (GDP) and internet use (see Table 1). For over a decade, those countries that have invested heavily in this space have yielded significant transformations in their economies.

Egypt, Vietnam and the Philippines are only the latest to realise this truth. In fact, Vietnam is ranked 57th, just below New Zealand. The big question is: Where will they be in a few years?

Will this new infrastructure allow countries like Vietnam to compete directly with our primary industries? Vietnam has already eroded Colombia's dominance of the world coffee market and severely damaged its economy – there is no reason why New Zealand couldn't be next. We need to understand what would happen if our competitors decide to disrupt our supply chains to dominate the market for themselves.

For over a decade, the mantra in national security has been that you can have both privacy and security, but this is a false premise. Huge amounts of information are being scooped up by governments, businesses and individuals. These databases are also being integrated together, creating unforeseen consequences that are beginning to negatively impact on people's lives.

COUNTRIES BY GDP AND INTERNET USEAGE

GDP Rank	Country	2014 (Billions)	Internet Rank	Country	2014 (Subscribers)
**				***	
1	United States	17,419	1	China	641,601,070
2	China	10,380	2	United States	279,834,232
3	Japan	4,616	3	India	243,198,922
4	Germany	3,860	4	Japan	109,252,912
5	United Kingdom	2,945	5	Brazil	107,822,831
6	France	2,847	6	Russian Federation	84,437,793
7	Brazil	2,353	7	Germany	71,727,551
8	Italy	2,148	8	Nigeria	67,101,452
9	India	2,050	9	United Kingdom	57,075,826
10	Russian Federation	1,857	10	France	55,429,382
11	Canada	1,789	11	Mexico	50,923,060
12	Australia	1,444	12	South Korea	45,314,248
13	South Korea	1,417	13	Indonesia	42,258,824
14	Spain	1,407	14	Egypt	40,311,562
15	Mexico	1,283	15	Viet Nam	39,772,424
16	Indonesia	889	16	Philippines	39,470,845
17	Netherlands	866	17	Italy	36,593,969
18	Turkey	806	18	Turkey	35,358,888
19	Saudi Arabia	752	19	Spain	35,010,273
20	Switzerland	712	20	Canada	33,000,381
** Internal Monetary Fund			***Compiled from ITU, UN, IAMAI, World Bank data		

Coupled with this is an emerging awareness that our critical infrastructure – like telecommunications and power grids, which support the backbone of our economy – is vulnerable to attack. In a highly competitive digital space, it's a war of attrition.

In recent years, completely overwhelming resources and capacity has been one approach by rivals through the use of distributed denial of service (DDOS) attacks.

Contemplate the loss of communication for a week, or even a month. In this digital isolation, what would become of our economy, relationships and society?

Traditionally, infrastructure needs have been based on population size but the threat landscape is now much bigger. We need to consider the cost of not expanding our capacities in order to keep the information flowing.

We must also consider what would happen if our own information is used against us. Customer details, costing and pricing structures, and other intellectual properties are all subject to competitive interests.

We need to focus on the things we do have the power to change – the information that flows through this infrastructure, its use, collection, storage, access and, one day, maybe its destruction.

A genuine public/private partnership is essential for ensuring everyone's prosperity in the digital future to come. Information protection is the key to our futures and New Zealand needs to revisit and strengthen its privacy laws to ensure its security in this space.

We need much greater discussion about who owns and controls our information; why information is retained and for how long; and who is actually held responsible when it is used against us.

Only with a robust framework for protecting digital information will we have a future where we need not be scared that our digital footprint will be used against us. ●

TIME FOR NZ TO ASSERT ITSELF IN ASIA-PACIFIC

We have benefited economically from the rise of Asia, especially from our lucrative exports to China. But are we ready to deal with the unfolding political, diplomatic and military rise and rivalry in the region?

Professor Rouben Azizian
Director of Massey University's Centre for Defence and Security Studies

Unabated religious extremism and instability in the Middle East, increasingly sophisticated cyber attacks, geopolitical and economic crisis in Europe and a plethora of old and new security threats in the Asia-Pacific region are increasingly threatening New Zealand's security interests.

According to the recently released Defence White Paper, these factors make it difficult for the country to protect and advance its security interests in the modern era.

New Zealand's perceived geographic insulation from external dangers is now redundant. There is general agreement that domestic radicalisation, fuelled by an international terrorist agenda, along with cyber threats, are making the traditional notion of border protection outdated.

Yet, at the same time, our proximity to the unpredictable security environment in the Asia-Pacific region is, arguably, more important than ever. Geography and geopolitics still matter and foreign policy choices can make New Zealand stronger or weaker.

We have benefited economically from the rise of Asia, especially from our lucrative exports to China. But are we ready to deal with the unfolding political, diplomatic and military rise and rivalry in the region?

As a result of the changing geopolitical landscape, we are likely to become more vulnerable and less influential in regional security affairs. Even the small Pacific Island nations are already openly challenging the predominance of Australia and New Zealand in the region through their closer ties with rising Asian powers such as China, India and Indonesia.

What should New Zealand do in these new regional geopolitical circumstances? There are basically two choices.

The first is business as usual. Continue to focus on pragmatic trade and economic interests, with an emphasis on relations with China and other growing Asian markets, and maintaining close security cooperation with Australia and other ideologically like-minded Western powers. This approach seems to be practical and logical as long as you can separate economic and security interests.

New Zealand can't afford to take sides in the US-China rivalry. That's why the government's reaction to the South China Sea disputes has been so balanced and carefully calibrated.

Wellington has called for freedom of navigation (a US priority) in the South China Sea and endorsed bilateral negotiations (China's preference), as well as a multilateral Asean (Association of Southeast Asian Nations) approach. This stance either assumes that all three options are complementary or, more likely, simply avoids taking sides.

This leads us to the second possible choice: we could play a more proactive role in closing the gap between conflicting views on what the international and regional rules should be.

This would be more consistent with the government's aspiration to promote a rules-based international order and Prime Minister John Key's recent reference to New Zealand as a "bridge-builder and problem-solver".

A passive, reactive response to nationalist agendas, growing regional tensions and power rivalry can work in the short term, but doesn't help ensure long-term regional stability. Nor does it guarantee long-term economic and trade benefits.

Speaking at the Council on Foreign Relations in New York in September, Key warned the US that failure to ratify the Trans-Pacific Partnership agreement would potentially cause it to lose geopolitical ground to China.

But the opposite is true as well – unattended geopolitical divides can undermine the free regional trade coveted by New Zealand.

The shaping of the regional security architecture is too important to be left to Asean, given its heavy hierarchical structure, strategic paucity and reluctance to deal with controversial security challenges.

During the Cold War, the neutral and non-aligned nations in Europe played a critical role in reducing tensions and building trust through a combination of regionally-agreed mutual concessions and gains. The Helsinki Accords led to a period of improved regional security order. The East satisfied its territorial concerns, while the West succeeded in promoting the human rights agenda.

Perhaps it is time to start designing a Helsinki-like process in the Asia-Pacific. New Zealand could become one of its advocates, taking advantage of its reputation as a fair and pragmatic nation, its good relations with China and improved ties with America. We are certainly in a better position to do that than, for example, Australia, which is constrained by a formal security alliance with the US.

The Helsinki process was also successful because it had strong input from civil society. New Zealand has a robust civil society but its role in security matters remains peripheral. Security policy is still primarily the perogative of government security agencies. To be more effective and progressive, our state security apparatus needs to welcome an increased level of public scrutiny and involvement.

The transition from old to new security thinking could be facilitated through the development of a comprehensive national security strategy. Many, if not most countries in the world, already have one.

The strategy should not be confused with a rigid action plan. Its primary goal would be to stimulate a whole-of-society conversation about national security and New Zealand's role in shaping international and regional affairs.

The security strategy should also redefine the sometimes unclear and overlapping roles and responsibilities of security agencies and provide for regular, inclusive strategic assessments. Such a strategy would enable New Zealand not only to successfully protect, but also advance, its security interests in the region. ●

SECURITY

Online recruitment means terrorism has global reach

We need to take seriously the fact that even if IS is destroyed on the battlefields of Syria and Iraq, its ideology won't be

We can't afford to be indifferent to the spread of extreme Islamic fundamentalism

Islamic State is a long way away so we don't really have to worry about it – right? Wrong, and that's not to say the international fear-mongering about "Islamic fundamentalism'" is on target.

Much of it isn't – but here's the thing: IS is not only a physical entity, with its own governmental infrastructure, it's also a powerful ideology shot through with ideas about salvation and restoring the perceived lost dignity of the global Islamic community.

Ideologies don't respect borders, whether in this part of the world or elsewhere. That means we can't afford to be indifferent to the spread of extreme Islamic fundamentalism.

New Zealand is already involved in the Middle East militarily through the training our troops do there, so we have an existing stake, and just last month a New Zealand man was jailed in Australia after being convicted of making plans to fight in Syria.

We need to take seriously the fact that even if IS is destroyed on the battlefields of Syria and Iraq, its ideology won't be. And in more than 30 countries around the world, a ragtag assortment of armed groups have pledged allegiance to the 'caliph' or Islamic State leader. That spells trouble for years to come.

Dr Chris Galloway

Head of Massey University's public relations programme. He has researched the communication and recruitment methods employed by IS

The messaging that motivates and mobilises people to fight for their vision of Islam is spread in a multitude of ways, but especially through social media.

Radical sympathisers have shown that social media platforms can provide spaces for effective recruitment, moving inquirers and especially disaffected youth from interest to action. Doing so doesn't require much specialised equipment – a laptop and know-how will do.

It's easy, therefore, for followers of IS-type Islam to exert influence online, and that's true even if the digital services they use are wise to their tactics and move quickly to shut down Islamist-linked accounts.

For example, the electronic jihadis practice what's known as 'swarmcasting'. Say someone posts a beheading video on Twitter. The strategy is to have as many sympathisers as possible download it before Twitter closes the account.

In one case, nearly 60,000 people had downloaded material before the account was shut. The downloaders then become 'disseminators' – sharing the video with their own networks so the distribution of the video shapeshifts like a flock of birds or a swarm of bees, constantly forming and re-forming.

The jihadis are alert to the attempts to stifle their online efforts, and have learned to use apps such as Telegram, whose messages are heavily encrypted and can self-destruct.

They've produced a guide on how to frustrate those wanting to disrupt their communication. Getting into the inner circles of contact can be a matter of recommendations from trusted radicals who usher potential recruits through progressively closer levels of engagement.

These recruits might be motivated by more than just a desire to fight. Reportedly an IS fighter captured by Kurdish Peshmerga troops told his captors: "Kill me now – I have to be in heaven by 4pm."

He wanted to reach paradise in time for a religious ceremony. That's the power of a religious ideology which, in its extremes, justifies everything from modern slavery to crucifixions, to brutal treatment of enemies including mass murders and attacks on civilians in Europe and America.

What does all this mean for New Zealand? We know (because the Prime Minister has told us) that our security services keep a watchful eye on some individuals in our society. Our watchdogs are alert to online as well as other forms of communication.

Does that mean the rest of us can relax? While it doesn't mean we should look at Muslim neighbours, including immigrants, with suspicion or fear, we do need to note what's happening in the world. Innocent people have been slaughtered in places as diverse as shopping malls, cinemas and transport stations simply because their murderers saw them as deserving of death.

The challenge is not to blame other Muslims for these crimes. We largely share the same aspirations: the best possible life now and a positive future for their children.

We should study extremism in all its forms, including that represented by IS. And we should engage with those whose views and values are different.

Understanding may not bring acceptance of the other's point of view, but it might help take the sting out of the bigotry and disillusionment that drives the ideologies sitting at the far end of the spectrum. ●

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The October attacks on global digital brands Netflix, Spotify and PlayStation, show that no company or organization, regardless of its size, is safe from a data breach. In 2015 the Cyber Edge group reported an alarming statistic that over half of the companies they surveyed felt a successful cyber attack against their network would take place within the year.

"In 2017 there will be more cyber security incidents than ever before – making the protection of your company's data, one of the most important decisions you have to make," says Maxine Elliott, Vocus Communications Wholesale, Corporate and Government Director.

As the provider of New Zealand's most modern fibre network, Vocus Communications has a history of working with large organisations and government bodies on business connectivity and is now extending the product portfolio in the security space, launching Vocus Hosted Firewalls.

"Not all cyber security products are created equal; it is crucial to get the right advice in selecting a product that meets your organisation's requirements and capabilities" says Elliott.

The first step most businesses take to mitigate the risk of lost data and business downtime due to cyber threats, is to establish comprehensive perimeter protection with a well managed, next generation firewall solution such as the new Vocus Hosted Firewalls. Key features of this product include:

- Anti-virus, anti-spyware, anti-spam, web/content filtering and Intrusion Prevention System (IPS)
- High availability, 24/7 protection
- Secure, remote access for connectivity by branches or remote workers
- Analytics and reporting on alerts
- Managed by experts so you know it's always offering the best protection possible for your network and devices

"With the huge surge in cyber threats it is crucial clients are proactive in protecting their businesses and preparing their backup plan. Preventing a threat is always the best protection – so if you are unsure in this area seek professional advice from an experienced organisation such as Vocus Communications," says Elliott.

SUPPLIED CONTENT

MAKING BETTER CYBER CHOICES

Today, anyone leading a significant company needs to understand that dealing with cyber crime is a reality

Ken Wallace
Partner at EY

"Cyber" is an overly-sanitised term.

When we talk about cyber, we're talking about conscience-free criminals who wouldn't think twice about taking a company down, costing jobs and potentially compromising the pensions of thousands who invest in these companies.

Cyber criminals are highly organised, well-resourced and highly motivated. Each year they cost global businesses more than US$600 billion and are on track to cost US$2 trillion per year by 2020. That's ten times New Zealand's GDP.

Speaking at a recent cyber security conference in Auckland, Prime Minister John Key revealed 856,000 New Zealanders (or one person in five of us) was affected by cyber crime in the past year at an estimated cost of $257 million.

A few years ago, engaging directors and senior executives in a conversation about cyber security was a challenge. Although the threat was emerging, it remained largely academic and was viewed as somebody else's problem.

Fast-forward to 2016 and what a difference time – and a raft of high-profile, multi-million-dollar, customer and brand impacting cyber-attacks – has made.

In the wake of the very public Sony and Target debacles, and last month's crippling denial-of-service attack on US and European internet services, and the emergence of day-to-day ransomware and whaling campaigns against New Zealand businesses of all size, it's clear that everyone is fair game. New Zealand businesses are being successfully targeted with million-dollar attacks.

Directors and executives now understand cyber is a day-to-day reality and that plausible deniability is no longer an option. Today, anyone leading a significant company is reasonably expected to understand that methodically dealing with cyber crime is a basic reality in 21st century business.

Many also accept that absolute security is no longer a credible ambition. The goal now is to reasonably mitigate the risk and prepare to deal with the consequences when an attack succeeds.

The challenge is figuring out what is reasonable and recognising that after an attack, your customers and shareholders will be the harshest judges of your efforts.

A good starting point to determine what is reasonable is to understand today's cyber reality. This means understanding the threat in general and how it applies to your business.

Some businesses have a dirty little secret around cyber. They're aware of the risk posed to their customers, shareholders and staff but choose to do little or nothing to reasonably address the risk.

There are a good reasons for this, including not knowing where to start, not understanding how to do it and/or not having the capability to deal with it. All are valid but none would offer much comfort to shareholders, customers or employees in the event of an attack.

There are five key steps company leaders can take to arrive at a reasonable response to cyber. The good news is that many will be familiar to anyone with any experience of mainstream risk management for a medium to large sized organisation.

The first step is understanding what is most valuable so efforts can focus on protecting it. If organisations don't understand this, they risk building $10 fences around $5 horses, wasting money on protecting things that matter relatively little.

This step is not complex and, for many companies, it can be based on mainstream risk processes. Simply build an inventory of everything that could be impacted by a cyber-attack, then classify each item according to its importance.

The list should include things like brand, share price, customer security, competitiveness, production technology and IP, as well as usual technical solutions.

The next step is to understand the risk. There are huge numbers of cyber threats but it's not practical nor commercially sensible to attempt to consider and manage all of them.

This step will identify threats that are worthy of most attention – the fights worth fighting. It is mainstream risk management; only the content is different. If you don't have the cyber knowledge within the company to do this, hire it in.

It's also worth understanding that cyber is different from other business risks in that it's evolving and growing rapidly, and it is goal oriented.

This is important. Cyber criminals are highly motivated and attacks can be very persistent. They can, and do, continue for months or even years until the attackers achieve their goal. This relentlessness is a key reason cyber is worthy of reasonable attention and response.

Only once the risk is well understood can leaders decide what is is reasonable for their customers, staff and shareholders. If the board and executive think the risk and the organisation's ability to respond is acceptable, then little additional action may be required, for now.

If it the board and executive decide the risk is unreasonable, they have a rational basis to more specifically define what would be reasonable. If there is an attack, this is where you can demonstrate you have made an effort to be reasonable.

If the current risk isn't reasonable, the next steps is to formulate a plan to mitigate it. Because few companies have the financial or delivery capacity to do all they might want to, it's important to create a realistic, balanced and workable cyber plan.

Typically, organisations define a two to three year roadmap to methodically address the risk in a controlled and cost efficient way. A common risk for companies at this point is selecting great cyber solutions that are not fit for their context. Push your teams to demonstrate specifically how they will make a difference to your company's cyber risk.

So what's the catch? There are a few.

PRIORITISATION

Although cyber crime is a day-to-day issue for many, it is still largely a risk-management activity. This means cyber sits below almost every revenue-generating and regulatory compliance demand on the investment plan. As companies and customers feel more impact from cyber-attacks, this will need to change.

CAPABILITY

Globally, it's estimated there is a shortage of more than 500,000 cyber professionals and New Zealand is short on skills also. If you don't have the people in-house to do this work, you will need to rent help if you need to. This applies at all levels. If the executive or board are not cyber-experienced, get some knowledge onto the team before you really need it.

FUNDING

Cyber capability can be costly but it's worth understanding there are lower-cost ways to address the risk. Cyber awareness and incident response capabilities are good examples of relatively non-technical actions that can make a significant difference without breaking the bank.

As we digitise New Zealand to compete globally, cyber crime is a non-negotiable fact of business life. Customers and shareholders will expect organisations to make a reasonable effort to deal with it.

If you've identified the risks but can't afford to do anything, then doing nothing may be reasonable. On the other hand, if you understand there is a risk and have the means to address it but choose not to, you may be judged more harshly should the worst happen.

In deciding what is reasonable, ask yourself this: after a significant security breach, could I stand up in front of my customers, shareholders and staff, and say, "We understood that this could happen and we did what we could to mitigate the risk. We're not happy that this has happened but because we were prepared, we're dealing with this as best we can".

The bottom line is that cyber is an endless stream of disappointment for business. This is an important point. If you ever aspire to becoming happy about anything to do with cyber, you're putting yourself in a difficult spot.

A company should view cyber as a gigantic pain. You're forced to spend hundreds of thousands of dollars – even millions – fighting remote criminals against whom you've got no redress. You don't know who they are, or where they are, and even if you did, nobody is going to do anything about it.

So aspire to being less angry and set realistic bars. Making a reasonable effort and managing expectations is the key to getting it right. ●

SECURITY

The internet of thugs?

Beneath the internet's visible surface, it is open warfare. Criminal gangs have moved from the physical world to the virtual world

The key now is to understand how attackers think

On Saturday morning at the start of Labour Weekend, New Zealand internet users had difficulty reaching their favourite websites. Twitter, Amazon, PayPal, the New York Times and Boston Globe were unreachable.

So were many others. They all suffered a distributed denial-of-service attack. The sites weren't only down for Kiwis; half the world couldn't get through.

Whoever was behind the attack exploited vulnerabilities in thousands of net-connected gadgets. They used a botnet called Mirai to take over web cameras, baby monitors and other devices with weak security. It involved tens of millions of web addresses.

From these devices the attackers sent wave after wave of junk data to web servers. This data tsunami overloaded the servers with incoming traffic to the point where legitimate users could not get through. That's why it's called "denial of service".

It was the biggest attack of its kind to date. Yet there's every likelihood that record will soon be broken.

Beneath the internet's visible surface, it is open warfare. There are serious incidents every day, but for now most remain hidden from normal users. We only get reminders when popular sites and services are in the firing line.

Cyber attacks take place despite businesses and governments spending over $NZ1 trillion ($US700m) each year on defensive cyber security.

One problem is that organisations are not spending their computer security dollars defending the right things.

Until now almost all the emphasis has been on perimeter defences. That is, building strong digital walls around systems with the aim of keeping the bad guys out.

Research shared at last year's HP Protect Asia Pacific and Japan 2015 event says most organisations spend five times as much on blocking unauthorised access as they spend on all other security measures.

Bill Bennett
Independent technology and telecommunications commentator for The New Zealand Herald

HP says building a higher wall is no longer good enough: at some point those attackers are going to breach defences.

The key now is to understand how attackers think. It also means recognising attackers can get inside a system.

Once organisations accept their networks can be penetrated they can work on plugging the internal holes and make it harder for attackers to wreak havoc from within.

Part of understanding attackers is knowing who they are. And that's where things get difficult.

In the past cyber criminals were often loners or small groups of what security professionals might term "individual actors".

They may or may not have been looking for financial gains. For some it was just a game. Often it was all about being in control or one step ahead of the defenders. Most of their activity amounted to little more than a form of vandalism.

Today the threat is quite different. Today's online attackers are looking for loot. Criminal gangs have moved from the physical world to the virtual world. Not only is that where the money is, there's also less likelihood of getting hurt.

The sums involved are huge. IBM and Ponemon Institute's 2016 Cost of Data Breach Study reports the average cost of a data breach for the companies surveyed increased from $US3.8m to $US4m last year. The cost for each lost or stolen record climbed from $US154 to $158. All the 383 organisations Ponemon spoke to had suffered a data breach of one kind or another.

Cleaning up after a data breach often costs more than the stolen data. And that's not all. If news of a major breach reaches the public, it can damage a company's brand. That's especially true when breaches involve sensitive customer data.

Online criminals are often organised in both senses of the word. There are functional structures in place that mimic those found in the commercial world.

Criminals form teams of skilled specialists. They band together to work on a single project, then share the rewards.

Often one specialist group will perform a single task, like penetrate a network. They sell their information to another group taking the next step in stealing money or blackmailing a victim.

It isn't just everyday criminals. There are many government-sponsored groups and quasi-official bodies operating in the online underground. They thrive on political instability. They may even be terrorists, but you'll find them everywhere.

Governments and their opponents see cyberspace as the next global battleground. At least some of the more worrying online activity stems from states jostling with each other.

In early October the US Government accused Russia of hacking the Democratic Party's networks. It also warned that the Russia could interfere with the US presidential election.

Some US media reports suggested the Labour Weekend attack was a dummy run – computers and voting machines play a big role in American elections.

The internet was designed to be open. That makes it easy for people, computers and software programs to communicate with each other.

It grew from academic networks. The founders didn't build in protections for commercial transactions.

As the internet developed, criminals turned up and users built rudimentary defences with tools like antivirus programs and firewalls.

Over the years the open design has proved resilient. If a major disruption occurs, traffic often diverts around the problem and gets to its destination – it might just take a little longer to get there.

The internet works well. So does online commerce.

Every day a billion or more people go online to do their banking, to shop at virtual stores or to look for love. They also use social media services like Facebook and mail or messaging services to share pictures of cats and important private communications.

Much of this goes on without any problems.

Users still have confidence in the internet. Echoing this companies and government departments put ever more services online.

Yet, as the Labour Weekend incident shows, it's getting harder to protect data and people. The low-cost devices compromised were part of the nascent "internet of things".

Over the next few years the number of connected devices will climb from hundreds of millions to many billions including cars, fridges and medical equipment.

Each is a tiny computer and could be vulnerable. Criminals will take advantage of any perceived weakness.

It's possible that by the next US election, your coffee machine could have an illegal say in who becomes leader of the free world. ●

BUSINESS

The F-word: the new world of workplace flexibility

A range of forces are driving massive changes in our workplaces. The result? A more flexible and collaborative, but increasingly insecure, workforce

Tim Bentley
Professor of Work and Organisation at Massey University's School of Management and a founding member of Massey's Healthy Work Group

Our workforces are entering a new age of flexibility, driven by new digital technologies, globalisation, environmental pressures, changing demographics and new forms of social interaction and organising. But flexibility is a double-edged sword that can be both good and bad for workers.

THE GOOD: FLEXIBLE WORKING

Technology has transformed how, when and where work routines and personal activities are conducted. One critical and rapidly growing development in working practices, enabled by digital technology, is the notion of 'anywhere, anytime working', also known as flexible working.

Studies from several countries have shown productivity benefits from flexible working. Workers save time and energy by not commuting at peak times, or at all; they have increased autonomy and uninterrupted working time.

Such arrangements also provide for greater work-life balance, increased individual wellbeing and retention within the workforce.

In today's workplace, flexible working is no longer thought of as a perk, but as a legitimate option for not only those with care responsibilities, but anyone who does 'knowledge' work.

Organisations are rethinking what work is – rather than a place, work is now a process than can be done anywhere.

An increasing number of organisations internationally are adopting flexible ways of working, including working from home and co-working centres and hubs.

While accurate statistics are hard to find, it is clear that many workers around the globe now work remotely. For example, around one-quarter of European workers were identified as being remote workers as long ago as 2010.

Current information also indicates an increasing trend of work mobility in this part of the world. A joint Massey University and AUT study of over 1700 staff across 50 Australian and New Zealand organisations found 89 per cent worked remotely at least some time during the working week. More than half worked from home at least one day per week.

Flexible working is particularly desirable for digital natives, with a recent Dutch study of Generation Y (18-25 year olds) workers finding 87 per cent would like to work in a mobile way. These and other studies suggest there will be an increasing demand from employees for flexibility in the coming years.

So how prepared are New Zealand organisations to meet this challenge?

The answer can be found by looking across the broad employment environment in this country. At government level, there is no one body responsible for promoting this aspect of the digital economy, as far as we can see.

With a lack of leadership at national and industry level, our research tells us that most organisations do not have formal policies nor formalised work arrangements in this area, although most are aware of the potential technology brings and the need for supporting new ways of working.

Many managers are stuck in outmoded ways of thinking and strongly resist new forms of working – particularly those where the employee cannot be readily monitored. This is largely a matter of trust.

This is a major cultural restraint towards achieving significant growth in digital productivity and should be an important focus for industry and government. When you overlay legislation changes around flexibility, this becomes a key issue for organisations to grapple with.

THE BAD: INSECURE EMPLOYMENT

While many workers are demanding and gaining the benefits of flexible working arrangements, there is a growing proportion of our working population who are becoming the working poor.

These low-skilled and unskilled workers compete for service roles with poor pay and conditions and, increasingly, insecure employment contracts.

The worst of these are known as zero-hours contracts – a punitive contracting arrangement that provides only disadvantage to the worker and high flexibility to the employer.

The government has fortunately resisted the advance of such contracting practices in New Zealand to date and should be applauded for this.

But other similarly punitive contracting arrangements remain and are growing in popularity among employers.

The lack of union membership outside the public sector and the increasing casualisation of the workforce means that many workers are not protected by employment legislation and have little or no voice in matters affecting their work.

This is a challenge for government to grapple with now, but there seems little sign of policy-making in this area, although the Labour Party's Future of Work Commission is taking stock of these and other issues.

Within the next decade, technology and other forces will fundamentally shift the way business is done, the way we work and how we live.

A New Zealand business environment that is flexible, future-ready and prepared to exploit opportunities presented by these changes is essential to our future economic and social wellbeing.

If we are to grasp these opportunities, government and organisations must make future-proofed policy decisions and put in place practices that improve organisational and individual outcomes in the future of work. ●

Getting the best from an ageing workforce

Population and workforce ageing is a global trend and the challenge New Zealand faces is considerable.

Among OECD countries, New Zealand recorded the second highest employment rate of people aged 55-64 in 2012 and 2013 and third highest for people aged 65-69 in 2012.

Given the prevailing stereotypes held by many about the working capabilities and limitations of older people, Massey University and AUT conducted research with a large number of New Zealand businesses and individual older workers to see how well prepared we are as a nation to meet the challenge of an ageing workforce.

Interestingly, older workers plan to retire at an average age of 66 – one year beyond the current age of eligibility for NZ Superannuation. But the bad news is that many believe they will not be financially able to retire until later – with an average realistic retirement age of about 67.

So, how will organisations best ensure the continued positive engagement of workers who are ageing and might otherwise have liked to retire?

Our study showed that the two key things older workers want if they are to remain productively employed are recognition and respect and flexible working arrangements.

The good news for employers is that neither of these need cost anything, and both are good practice for organisations wishing to engage and retain their valued staff – regardless of age.

But organisations need to do more than this if they wish to maximise the opportunities that an older and more experienced workforce can offer. Jobs need rethinking and redesigning so that the capabilities and limitations that come with ageing are considered.

Redesigned jobs should build in opportunities for mentoring and skill transfer, as well as increased rest time and more autonomy and variety in work.

Many older workers have grandparenting or community responsibilities and value flexibility around where and when they work. This, according to our study participants, is more important than pay rates or other conditions.

Another approach that should be attractive to both older workers and organisations is graduated retirement. Why do we need to work until the date of our retirement and then abruptly stop?

This seems psychologically and socially unhealthy – unless you hate your job. It is also potentially unhealthy for the organisation, which will suddenly say goodbye to a wealth of knowledge and skills. – **Tim Bentley**

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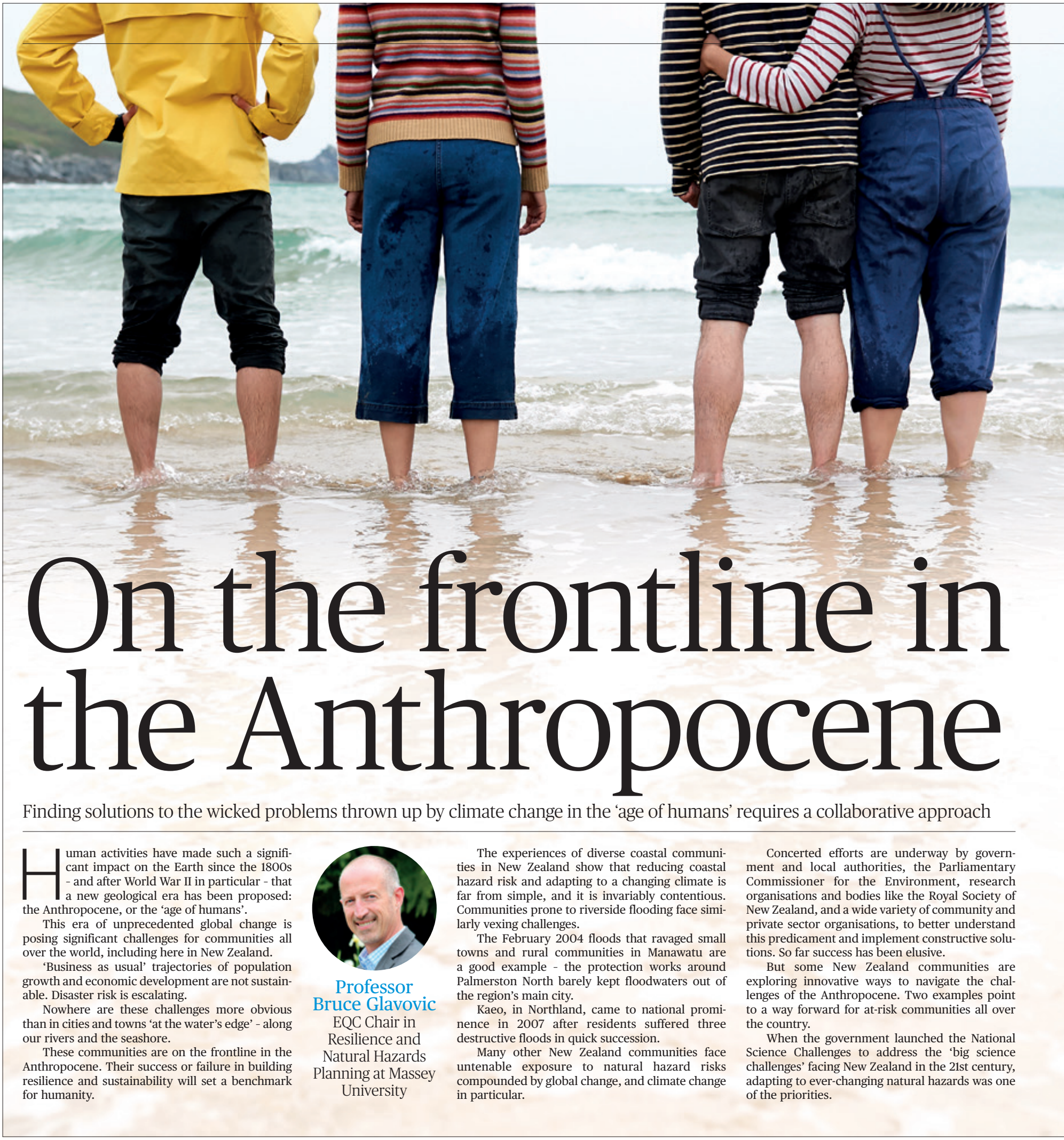


On the frontline in the Anthropocene

Finding solutions to the wicked problems thrown up by climate change in the 'age of humans' requires a collaborative approach

Human activities have made such a significant impact on the Earth since the 1800s – and after World War II in particular – that a new geological era has been proposed: the Anthropocene, or the 'age of humans'.

This era of unprecedented global change is posing significant challenges for communities all over the world, including here in New Zealand.

'Business as usual' trajectories of population growth and economic development are not sustainable. Disaster risk is escalating.

Nowhere are these challenges more obvious than in cities and towns 'at the water's edge' – along our rivers and the seashore.

These communities are on the frontline in the Anthropocene. Their success or failure in building resilience and sustainability will set a benchmark for humanity.

Professor Bruce Glavovic
EQC Chair in Resilience and Natural Hazards Planning at Massey University

The experiences of diverse coastal communities in New Zealand show that reducing coastal hazard risk and adapting to a changing climate is far from simple, and it is invariably contentious. Communities prone to riverside flooding face similarly vexing challenges.

The February 2004 floods that ravaged small towns and rural communities in Manawatu are a good example – the protection works around Palmerston North barely kept floodwaters out of the region's main city.

Kaeo, in Northland, came to national prominence in 2007 after residents suffered three destructive floods in quick succession.

Many other New Zealand communities face untenable exposure to natural hazard risks compounded by global change, and climate change in particular.

Concerted efforts are underway by government and local authorities, the Parliamentary Commissioner for the Environment, research organisations and bodies like the Royal Society of New Zealand, and a wide variety of community and private sector organisations, to better understand this predicament and implement constructive solutions. So far success has been elusive.

But some New Zealand communities are exploring innovative ways to navigate the challenges of the Anthropocene. Two examples point to a way forward for at-risk communities all over the country.

When the government launched the National Science Challenges to address the 'big science challenges' facing New Zealand in the 21st century, adapting to ever-changing natural hazards was one of the priorities.

The challenge is called Resilience to Nature's Challenges; it includes a focus on coastal hazard risk and climate change adaptation research.

Researchers have partnered with those responsible for developing the Hawke's Bay Coastal Hazard Strategy 2120 – and several distinguishing features of this partnership deserve highlighting.

First, the 100-year time frame compels consideration of the distant future – a vital perspective for any genuine effort to navigate inter-generational concerns in the Anthropocene.

Second, the strategy is a truly collaborative effort. It has been developed by the Hastings District Council, Hawkes Bay Regional Council, Napier City Council, groups representing mana whenua and tangata whenua, and it actively involves private sector and community stakeholders in the region. Such active collaboration is essential to resolve complex public problems.

Third, involving independent researchers with relevant expertise has helped to co-create a robust foundation of knowledge that underpins the strategy's development.

Traditionally, experts are often pitted against one another in an unproductive and adversarial way that hinders, rather than helps, the building of a shared understanding of the situation. This then delays the implementation of solutions.

Homesteads, farmers and small communities in the Whangaehu Valley in the Rangitikei district of Manawatu have been flooded four times since 2004.

With modest funding from the Civil Defence and Emergency Management Resilience Fund, a collaborative initiative has been set up to enable flood-ravaged communities to work more closely with government.

The aim is to develop a shared understanding of the scope of the flood risk in the Whangaehu Valley and develop a risk-reduction and resilience-building action plan. A key feature of the initiative is its focus on implementing the plan in a way that can adapt to inevitable future changes.

I have the privilege of working as the independent facilitator of this process under the guidance of an advisory group that, again, is truly collaborative in its approach. It includes representatives from Ngati Apa (Whangaehu and Nga Wairiki Ki Uta), Federated Farmers, flood-affected people and the Rangitikei District Council, Wanganui District Council, Horizons Regional Council, Ministry of Social Development, Te Puni Kokiri and the Ministry of Civil Defence and Emergency Management.

An underlying goal is to create a 'safe arena' for difficult conversations, because climate change means making hard decisions about which assets and ecosystems can be protected against a backdrop of divergent interests.

The Whangaehu Valley community is building a process for co-designing a risk-reduction and resilience-building plan that takes into account the values, concerns, issues and realities of all parties.

This is the way forward for any community 'on the frontline' in the Anthropocene. Local authorities must work collaboratively with tangata whenua and mana whenua, community stakeholders, the private sector and government, if solutions to the 'wicked problems' thrown up by climate change in the 'age of humans' are to be found. ●

When the government launched the National Science Challenges to address the 'big science challenges' facing New Zealand in the 21st century, adapting to ever-changing natural hazards was one of the priorities.

Paradise lost: planning for climate refugees

If sea levels rise at predicted rates, many of the low-lying islands in the Pacific will be under water by 2050. Yet there is no coordinated plan for assisting up to 1.7 million displaced people

Associate Professor Malakai Koloamatangi heads Massey University's Pasifika Directorate and is co-director of its Pacific Research and Policy Centre

The prospect of refugees washing up on New Zealand beaches may seem unlikely, but the Pacific will soon face its own crisis as whole nations flee, not from war, but from climate change.

It's not a matter of if; it's a case of when. And despite a great deal of talk, not much has been done to plan for this catastrophic eventuality.

For countries like Tuvalu and Kiribati, the need to evacuate people to safer ground will be a very real prospect in the coming decades.

According to the London School of Economics' Brookings Institute, between 665,000 and 1.7 million people in the Pacific could be displaced or forced to migrate by 2050.

Some low-lying atolls have already been submerged and others face issues of food security as saltwater seeps into the land, affecting crops and freshwater supplies.

In some areas of Tuvalu the atoll is only one to two metres above sea level – even moderate-sized waves have the potential to swamp the island. Near the capital, Funafuti, where the atoll is very narrow, waves can literally wash from one side to the other.

But other island states are also facing problems. I've seen islands in Tonga that have disappeared and there are some islands, if approached by sea, that look as if the coconut trees are growing out of the ocean because the land is so low.

But it's not only the land that's in danger. Nations facing the prospect of being displaced also risk losing their culture.

Losing your connection to the land can be catastrophic for cultural identity. When your link to your homeland is cut because you are forced to shift elsewhere, it affects your sense of self and the way that you live.

We've seen this before – when people from parts of Micronesia, displaced by American nuclear testing or by foreigners' desire for phosphate, were shifted to other parts of the Pacific.

The cultural devastation caused is irreparable. The land, the whenua/fonua on which your culture is based, cannot be replaced by someone else's whenua/fonua, so the destruction is complete.

The ultimate irony is the issues facing the Pacific are not of the region's own making and they have no control over the impacts of climate change.

The industrialised countries of the world need to sit up and do something; they are morally obliged to help find solutions to the problems they have created.

At the United Nations Climate Change Conference in Paris one year ago, we saw industrialised nations pay lip service to change. This is because they don't see climate change affecting them in the immediate future.

Unfortunately it's those very countries that have the power to slow global warming if they cut carbon emissions. Without drastic change, the prospect of Pacific refugees will become a reality.

New Zealand needs to start thinking seriously about how it will respond to the situation and come up with a structured programme for dealing with some islands in the Pacific becoming uninhabitable.

The current government is turning a blind eye, preferring to deny that climate change refugees exist. Of course there are political reasons for doing so.

After the Paris conference Kiribati, Tuvalu, Fiji and Tokelau called for an international body to coordinate population movement caused by climate change – an idea that was dropped by the United Nations because of opposition from Australia.

But New Zealand could take the lead through the Pacific Islands Forum to get meaningful planning underway.

New Zealand courts have already heard a small trickle of appeals by Pacific Islanders using climate change factors in a bid to gain refugee status.

These bids have, so far, been largely unsuccessful. But there will be a time when such cases become a flood.

While New Zealand will have to consider how many climate refugees it will accept, bringing people to New Zealand isn't the only option. With proper planning, there are other options to explore, including relocation to those Pacific countries facing de-population.

Niue could easily accommodate Tuvalu's 10,000 people, for example, and the Cook Islands could also look to grow its population by becoming a refuge.

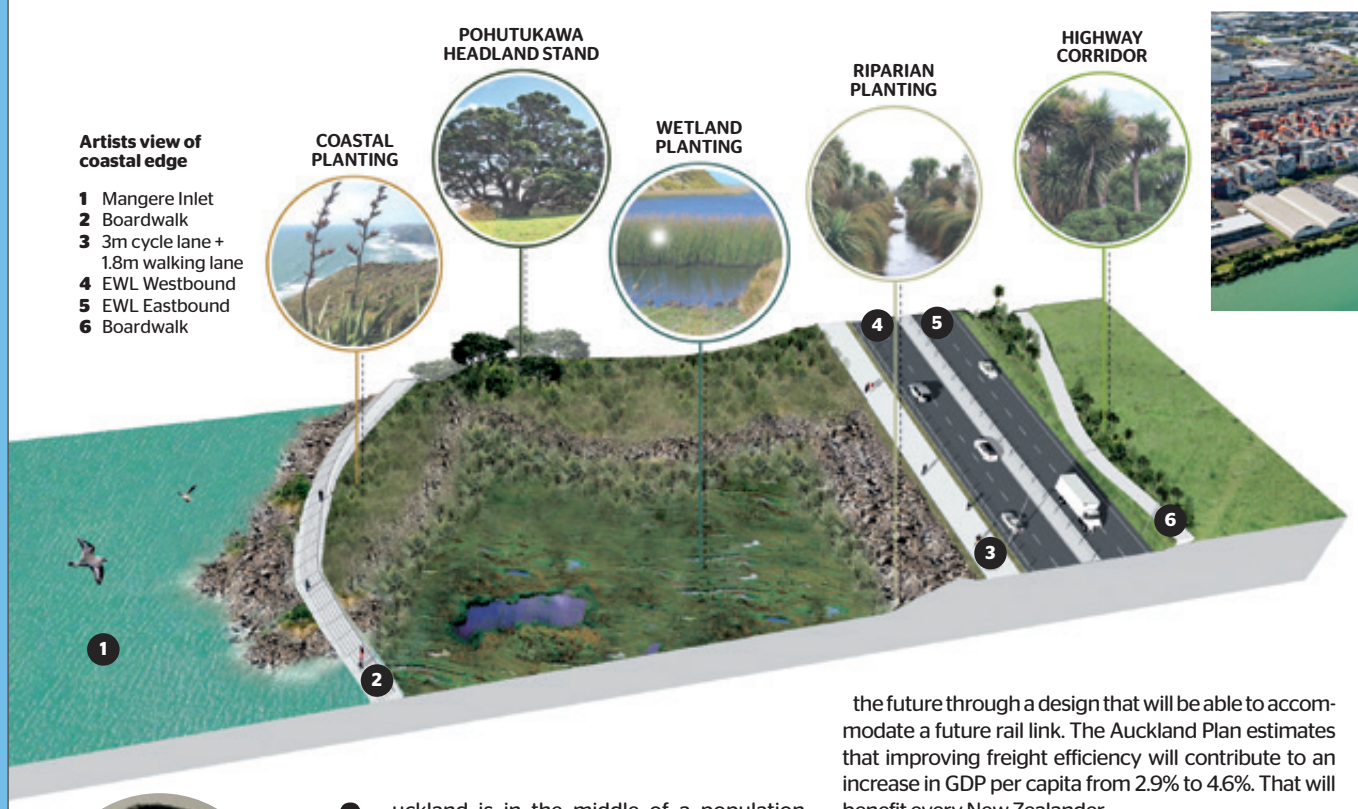
What Pacific countries also need is funding to raise buildings above predicted sea level increases and safeguard water supplies from saltwater intrusion.

This sort of support should be complemented with health and education programmes to prepare Pacific Islanders for 'migration with dignity' – the ability to contribute to other nations' economies as skilled migrant workers. ●

SUPPLIED CONTENT

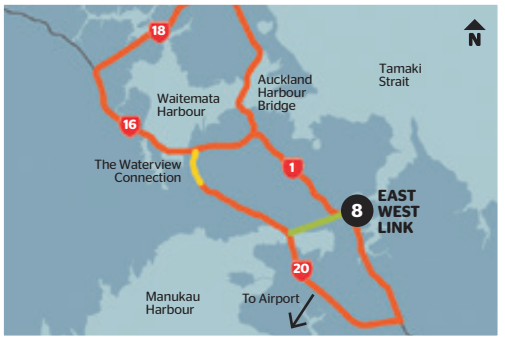
Giving people their streets back

As the engine room of NZ's industrial and manufacturing economy, Onehunga-Penrose is a key piece in the country's transport puzzle. So, what's the plan?



7 Southdown entrance
8 East West Link

Picture / Greg Kemphorne Photography



Brett Gliddon
NZ Transport Agency Auckland Highway Manager

Auckland is in the middle of a population boom that will change the way people live, work and move around the city. We need to invest now in developing and shaping that future, and building the right transport infrastructure in the right places and at the right times is an essential component in building a prosperous city. The Auckland motorway network is an important component within a wider strategic transport network that connects the entire upper North Island. The soon to be completed Western Ring Route will provide an additional route to State Highway 1, providing a safer more resilient network that gives customers more choices about how to move around.

The East West Link is a key part of the greater Western Ring Route that connects State Highways 1 and 20. As the engine room of New Zealand's industrial and manufacturing economy, the Onehunga-Penrose area is a key piece in the country's transport puzzle. Many of the largest distribution and logistics facilities are based in the area because of its proximity to state highways, the rail network, the airport and the port. However the current transport connections into and through the area are either incomplete or highly congested. This makes it slower and more expensive to move freight, and these costs are passed on to customers. It also makes it harder for local residents and businesses to get around. With freight movements expected to double by 2035, we need to start building solutions now. That's why the Government, through the NZ Transport Agency, is investing up to $1.85billion on the East West link, to provide a link between the Southwestern and Southern Motorways. The project will also allow for more freight to be moved by rail in the future through a design that will be able to accommodate a future rail link. The Auckland Plan estimates that improving freight efficiency will contribute to an increase in GDP per capita from 2.9% to 4.6%. That will benefit every New Zealander.

The project will build a new four lane road between the Neilson Street Interchange at State Highway 20 and the Mt Wellington Interchange on State Highway 1, and widen State Highway 1 between Mt Wellington and Princes Street. It will also create a new access road for the existing inland port at Southdown and create a consistent and direct walking and cycling link from Onehunga to Sylvia Park.

IMPROVING ACCESSIBLITY TO CREATE MORE CONNECTED COMMUNITIES

At the heart of transport investment is the ability to revitalise communities and connect them with jobs, schools and services. Our vision is to create an area where the community gets its streets back. By taking freight off local roads it will free up Onehunga town centre, making it a safer and more attractive place to work and live. This will also mean local business owners can safely and reliably access their properties and their markets. We want to make it easier for them to do business, by creating more reliable journey times. More than 80% of those who work in the Onehunga-Penrose area travel from other parts of Auckland. Taking traffic off local roads will make public transport more efficient, while 23kms of new cycling and walking paths will mean travel times are also reduced for those walking and biking to work, to the shops and the waterfront.

We want to make Onehunga Wharf and the waterfront more accessible and help reconnect the communities with the Manukau Harbour. The NZ Transport Agency is working with Auckland Council, Panuku Development Auckland, Auckland Transport, Mana Whenua, and the community to replicate many of the community facilities that we have created along with Auckland Council further east along the harbour on the Onehunga Foreshore and that's become a popular recreational area. The East West Link will create a more natural coastal edge that better reflects the original shoreline.

The design of the upgraded interchange at State Highway 20 enables future development of the wharf to take place by separating local and motorway traffic and providing direct local road access between the wharf, the town centre and the railway station. By lowering the road we will also reduce its visible impact on the area.

CLEANING UP A CENTURY OF POLLUTION

Because of its long history as an industrial and manufacturing hub the Mangere Inlet is now suffering from the decades of discharges which have damaged the ecology and water quality. The East West Link is taking a holistic approach, making the most of this large scale transport development as an opportunity to restore the neighbouring environment. The project is proposing an embankment along the foreshore which will have wider benefits. Creating a more natural coastline and providing new wetlands will capture and treat stormwater run-off from the wider Onehunga and One Tree Hill catchment. By improving the quality of water being discharged into the harbour we can improve its overall health. Like we've done so successfully further along the Onehunga Foreshore at the Taumanu Reserve, we can create an outdoor environment that invites wildlife to return and is a place that people can enjoy.

The Onehunga-Penrose area is special, we understand that, and are working to make it more accessible, safer and more pleasant, by removing truck and through traffic off the overloaded local streets, connecting communities and improving access to the Manukau Harbour. ●

EDUCATION

Brave new digital world of the classroom

Many schools and parents have mixed feelings giving children their own digital device in the classroom. Do we need to prepare children to be responsible, safe and secure in the new global, digital world?

Evelyn Lewis
PhD candidate with Massey University's Institute of Education and an educator with over 25 years of experience in the classroom

One initiative challenging the boundaries of traditional schooling is the introduction of digital technology into classrooms.

'Bring your own device' or BYOD – is a much-heard acronym inside and outside schools today. It describes situations where, rather than using school computers, students are encouraged to bring their own portable digital device to classes.

The underlying concepts are not only to provide a ratio of 1:1 student to device, but to encourage continuing learning outside the classroom. Having their own device allows students to continue to work seamlessly on research and assignments at home.

While there are many positives, there are some downsides too. There are two significant factors in this debate: student ownership and cost.

When all students have the same device it's easier for the teacher to support learning and to help solve technical issues when they arise. But it is a bit like a school uniform – the cost of the specific device has to be borne by whanau.

And insisting students use a particular device can hamper their enthusiasm and constrain their ability to manage and take control of their own learning.

Enter the second generation – 'Bring your own technology' or BYOT. By removing the requirement to use a specific digital device, schools are recognising that many students have mobile devices that can connect to the internet and be used to support learning.

When the costs associated with a school-designated device are removed, whanau and students can decide what device they already have that can be brought to class.

A dedicated device is no longer essential – being able to use one device for multiple purposes is not only sensible but cost-effective.

Students will be highly familiar with their chosen device, often spending their own time – out of school – exploring and discovering the best apps – for them – to complete certain tasks.

While teachers may not have the same confidence and skill level to problem-solve across multiple types of device, students' familiarity with their own devices can be used to learn and discover these skills.

But some schools and teachers are concerned about BYOT. It opens up the classroom door to devices like mobile phones, with all the possible distractions that can bring.

While this is a genuine concern, it appears, to me, that it also introduces opportunities for teaching moments.

Teaching young people skills to apply when navigating the internet will help keep them safe

How many of us, as adults, go anywhere without our mobile phones?

As they have developed to be part of our lives we have learnt when it is appropriate to check and send messages, as well as when to take or make phone calls. By teaching these behaviours we can do our students a service.

This also applies to what students are actually able to do with their devices in lessons. We all know the internet is a potentially hazardous place.

To navigate it to find accurate and trustworthy information, requires the development of digital literacy skills and critical thinking skills. These are life skills that teachers need to be able to teach their students.

Schools all too often impose draconian firewalls on their internet in the name of safety. Blocking access to internet sites deemed inappropriate for school, such as YouTube and Facebook, on the surface may be a sensible move.

Rather than blocking sites, shouldn't we be teaching our students what it is and is not appropriate to be accessing via the internet to support their learning?

Consider this. How do young children learn to cross the street? Hold hands with an adult. Stand at the side of the road. Look both ways, walk sensibly across, looking and listening all the time.

As they get older and need to pass these skills onto others, we encourage them to use their judgement. See how fast the vehicle is travelling towards you. Use this to make an informed decision about whether to cross now or wait a little longer.

In schools we often lock down internet access. We don't routinely hand-hold to demonstrate how to know which sites are safe to access. That means we are not teaching the life skills of digital literacy and critical thinking as integral parts of the school curriculum.

Think about the road crossing analogy. Can you learn to judge speed without someone supporting you to do so – or do you just make a dash for it and hope for the best?

Schools are at a new place in history. Teachers no longer control access to knowledge and information – if you want to find out something, ask Google.

Instead, teachers need to teach their students how to access knowledge and trustworthy information in safe ways.

Keeping young people safe in classrooms by reducing access to the world outside won't keep them safe when they are out there. Teaching them skills they can apply when navigating the internet via digital technology can. ●

ENVIRONMENT

DAMNED DAMS

The debate around the impact of large-scale dams is often one-sided. Claims of economic and environmental benefits are rarely borne out by the facts

Drought has cost some New Zealand farmers dearly in recent years, which has led many parts of the country to consider large-scale irrigation schemes.

But we have seen with the Ruataniwha irrigation dam how the whole process can go wrong – millions of dollars spent over many years and nothing to show for it but a divided council and a divided local community.

It is crucial that, in the irrigation debate, there is even-handed coverage of pros and cons. But, to date, claims of economic and environmental benefits are rarely, if ever, balanced by coverage of the negative environmental and economic impacts.

The two main claims made by dam proponents are that the irrigation schemes will be good for river ecology and they will mitigate climate change impacts. Both assertions are erroneous and, worse than being false, the opposite is true.

First, let's take the climate change claim. Rather than mitigate climate change, large-scale dams actually make farms less resilient, and both dam reservoirs and inevitable intensification create even more greenhouse gas emissions.

Intensification is inevitable because to fund the very expensive cost of constructing and maintaining a dam, a high price is put on water for irrigation. For the farmer to pay this added cost, they must intensify. In most cases this is based on conversion to dairy farming.

Dr Mike Joy
Freshwater ecologist at Massey University's Institute of Agriculture and Environment

This leads to greater dependency on the water from the dam, and when water becomes scarce, farmers are at even more risk as they then have more animals and crops. Inevitably, they become less resilient.

An unfortunate example of this is the Opihi irrigation dam in South Canterbury. To pay for the water farmers intensified so water consumption went up.

Meanwhile, rainfall and snowfall decreased so, in the last few years, there has not been enough water to fill the dam and keep water flowing in the river and to farmers.

As predicted, the water quality in rivers downstream has declined dramatically; the community and farmers have lost out.

In reality, the only way a dam could possibly mitigate climate change would be if it did not lead to changed land-use or water-use, and the water was not touched until needed to mitigate a drought.

The second claim is there are ecological gains from dams. While these claims are never specific they seem to be around the vague notion of "flushing flows".

But, like the toilet, you only need to flush it when you have created the need. Intensifying farming means diffuse nutrient loss, leading to algal blooms, algal blooms kill fish and other life in the river and make it unsafe to swim. So any need to flush is driven by intensification.

Dams drive intensification so it's a completely circular argument. Damming a river also removes any natural flushing flows so the idea that it is a gain to take away the natural flow variability and replace it with an artificial one is just daft.

Unlike the few paragraphs needed to unravel the loose thinking of dam salespeople, thousands of words would be required to detail the long list of negative ecological impacts.

So, instead, let me point to a recent peer-reviewed scientific paper. It was published in a top freshwater journal that reviewed 165 scientific papers on dam impacts and found that 92 per cent of them reported declining or negative ecological measures as a result of dams.

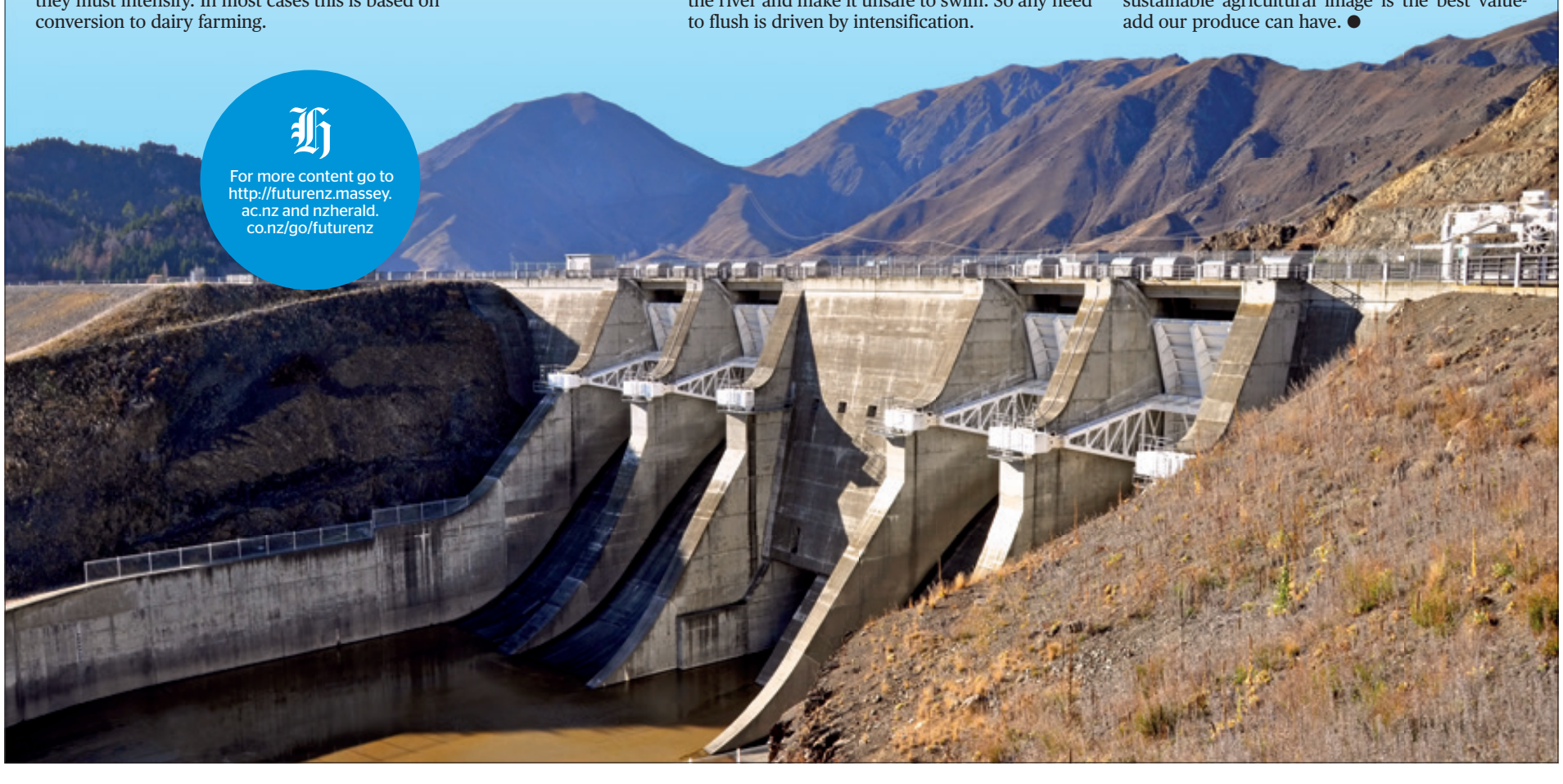
Other countries are recognising these negative effects. The US, for example, has stopped building new dams and now dams are being removed from many rivers.

Large-scale dams are a folly because large-scale water storage locks us all in to a high-risk, high-cost, high-impact system.

The way to grow food for the future is farm-scale, on-farm water retention and there are already many proven ways to do achieve this.

New Zealand agriculture must be based on clean, healthy sustainable farming that matches land use to climate. Maintaining a clean, healthy, sustainable agricultural image is the best value-add our produce can have. ●

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



ENVIRONMENT

An ecologist's dream of a predator-free NZ

Can New Zealand really become predator-free by 2050? A personal view from the frontline

Harm and death to native birds, reptiles and insects caused by invasive predators is easy to see

Professor Dianne Brunton

Ecologist and expert on native birdsong and conservation. Acting head of the Institute of Natural and Mathematical Sciences at Massey University

For me there is no room for indecision; we should endeavour to make New Zealand predator-free.

This does not mean trying to remove every invasive species, plant and animal, that we have. It very specifically means ranking invasive predators in terms of the harm that they do to our native biodiversity and to our economy.

We know who the culprits are: they are stoats, rats and possums and they are feral and uncontrolled domestic cats.

I am an ecologist so I will focus on the native biodiversity. The direct harm and death to native birds, reptiles and insects that these invasive predators cause within our native ecosystems is easy to see, and has been extremely well quantified and documented.

Our native forests are quiet, undergrowth can be sparse or a monoculture of introduced weeds and native trees are dying.

The combination of changing climates, habitat degradation by land-use changes, and the spread of invasive predators is lethal for New Zealand's ecosystems.

I have been fortunate enough to visit many island sites that have either been protected due to their isolation or protected more recently by successful pest control by the Department of Conservation alone, or in partnership with the flourishing community conservation groups around the country.

These places are magical, the diversity and uniqueness of our native species is breathtaking. Islands such as Hauturu/Little Barrier are filled with noise and activity, day and night. Today the public can visit mainland and island sites which exemplify this biodiversity.

Sir Paul Callaghan mooted the idea of a predator-free New Zealand not long before he died in 2012. His vision was to have everyone behind the concept of removing predators and enabling native biodiversity to flourish; a totally unique assemblage of plants and animals, most found nowhere else on Earth.

Many, if not most, New Zealanders are behind this goal; the devil is, however, in the detail. We don't all agree on how to get there.

Many people are opposed to the use of aerial poisoning or any poison use; many feel that every life is important; others value our native biodiversity over introduced predators.

Yes, the predator-free New Zealand goal is aspirational but we have already come a very long way and achieved predator eradication in larger areas that, as recently as the 1980s, were considered impossible.

We lead the world in this field; in 1960 the first eradication of rats accidentally occurred on a 1ha island by Forest and Bird volunteers; just 40 years later rats were successfully eradicated from the 11,300ha of Campbell Island.

There is one issue to immediately make clear: no one is advocating inhumane methods of pest and predator control.

Humane, targeted control is the gold standard and researchers around the country are continually refining methods, developing new approaches, and assessing outcomes.

Remember the objectives are not the number of dead stoats or rats but the increases in populations of native birds, reptiles, and insects and the health of our ecosystems.

The $28m in government funding (or $7m per year), announced in July, will not make New Zealand predator-free by 2050; everyone agrees on this point.

How much will it cost? This is difficult to estimate, but it will be substantial. Landcare scientists estimate at least $25m a year is needed in pest control just to maintain current key areas at low predator/pest levels.

But the case for greater investment is strong. There are many economic benefits to removing predators and pests and enabling native biodiversity to thrive.

Nature is our main tourist attraction – and tourism directly contributes more than $7b to our GDP. Our 100% Pure brand, rightly or wrongly, supports the marketing of exports.

The publicity generated by predator-free New Zealand has already been significant and building the country's reputation for enhancing its natural environment will surely offset the required funding for good predator and pest control, as well as other environmental initiatives like improving freshwater quality.

Research into effective measures requires an unknown amount, but the seed funding that was committed to by the government in July will allow scientists and conservation practitioners to provide proof of concept; innovations in effective control techniques require imagination and skill. Everyone is watching this space with interest. ●

HEALTH

Ageing with dignity is a basic right

For many people, age is just a number. But ageing is also emerging as one of the greatest areas of inequality

We need to think about cost-effective, workplace-sensitive and attractive ways to support an ageing population

Professor Jenny Carryer

Professor of Nursing at Massey University's School of Nursing and executive director of the College of Nurses

Recently, a close friend observed a proud and dignified elderly woman in care request a trip to the bathroom, only to be told by a caregiver, "Just go in your pull-ups, dear... we are too busy."

This is a spectre that haunts us all; the notion of having all of our faculties but having lost every shred of dignity and independence. It is a grim thought and we only deal with it by refusing to believe it "could happen to me".

About the same time other similarly elderly friends returned elated and glowing after a planned extreme adventure overseas. This is why we now say that age is just a number – and for many people it is. But ageing is also emerging as one of the greatest areas of inequality.

The Dunedin Multidisciplinary Health and Development Study has revealed that stress and disadvantage as a child lays the foundations for chronic disease.

A life of poverty further ensures that lifestyle choices are limited, stress is maximised, and the scene is set for early onset of chronic illness and disability as a precursor to the ageing process.

Ageing, when compounded by disease and disability, is an even more challenging prospect.

The growing bulge of older people in our population is too well recognised to require further description.

At the simplest level, the number of people available in the workforce will progressively become disproportionately smaller than those who have retired, regardless of whether they are living independently or receiving care.

Available workforce is an issue for the provision of high-quality residential care, high-quality hospital care and the support systems that allow the elderly to remain independent and living in their own homes.

As a country, we need to be giving considerable thought to cost-effective, workforce-sensitive and attractive ways to support an ageing population. It is certainly in our interests to do so.

Such planning needs to accommodate the societal changes that have occurred, such as the need for families to have both parents working in order to survive, the rapidly rising costs of housing, the increasing levels of homelessness and the low level of personal savings held by many people at retirement.

All this impacts on how we structure services to older people and what people can afford in their golden years.

In a recent visit to the Netherlands to explore some of their innovations in aged care, a number of things stood out to me.

One stunning example was De Hogweyk, a village for the care of people with dementia. Founded 23 years ago, the village is resourced in the same manner and to the same level as all residential facilities, and receives people with severe dementia for permanent long-term care until death.

However, the person-centred approach to dementia care sets this facility apart from others both in the Netherlands and worldwide.

The village uses the notion of back stage (all mechanisms for the care of the residents) and front stage (their life, home, entertainment and autonomy).

The back stage is kept entirely invisible and residents live in houses of six or seven, which function independently in terms of food, laundry, gardening and resident engagement.

One to two caregivers are stationed in each house between 6am and 10pm, and manage the care of the residents alongside the cooking and laundry, assisted by any residents who choose to do so.

The character of each house is based on the previous lifestyle of the residents who are assessed prior to entry. This influences the choice of art on the walls, the music and even whether beer or wine is served at 5pm!

Residents respond to the normality of the environment with a major reduction in many of the distressing characteristics of dementia.

They wander freely, socialise – some recognised that we spoke English and responded in kind; they sleep in normal beds and have a busy social life.

The village contains a supermarket, pub, restaurant, a full theatre for musical shows and other normal amenities.

Further intentions for the village include a greater integration with the local community and increased freedom for residents.

This would be interesting in the context of our health and safety regimes. Normal life incurs risk but reducing risk removes freedom and choice, forcing dependence.

Normal life means having a range of ages present and the Dutch have some experiments with housing students cheaply in residential care settings or establishing childcare centres next to to elderly residents.

Whether we experience ageing as an opportunity to be experimental, to travel and spend our kids' inheritance, or whether we are living on a very reduced income or have major health challenges, older people should always be entitled to the essentials.

These include dignity, autonomy, respect, feeling needed and useful, feeling connected and part of a wider social sphere.

As the pressure of an ageing population increases, along with rapid social changes, we will need to change the way we build residential settings and support ageing at home.

We need to have some significant conversations about the widespread adoption of advanced care planning and we must become more focused on putting people, themselves, in the driving seat to determine how and where they live as they age. ●

POLITICS

Who will win the 2017 election and why?

All indicators suggest the National Party will win a fourth term in 2017 - and it's probably too late for Labour to do anything about it

Professor Claire Robinson
Political commentator and Pro Vice-Chancellor of Massey University's College of Creative Arts

History suggests National will overcome the 'third-term blues' to win another general election. Since 1998, the party leading the opinion polls in July of the year preceding the election has gone on to win the highest proportion of the party vote come election day. I'm prepared to make a similar prediction for 2017.

With the late June to August 2016 public opinion polls all showing National leading Labour by a margin ranging from 12 to 18 percentage points, National looks to be in pole position to form the next government.

To make sense of this we need to understand early deciding voters – those who reach their voting decision before the election campaign. In New Zealand they represent an average of 54 per cent of voters, 75 per cent of whom end up voting for a major party.

Importantly, early deciding voters have voted for the party that has won the highest proportion of the party vote in each of the last seven elections.

The two times that the government has changed in the MMP era (1999 and 2008) was after early deciding voters switched their vote decision from the major party challenger to the election winner the year before election year. This makes these voters a good barometer of the election outcome.

The chart to the right illustrates this with figures from the New Zealand Election Study.

Early deciding voters tend to base their decisions on a longstanding predisposition towards a particular party, as well as performance measures they know or can estimate long before the actual date of the next election.

Over the past three election campaigns an astonishingly high 73.8 per cent of National voters have reported reaching their voting decision before the start of the election campaign. These voters know the National-led government, their policies, their ways of working and John Key's leadership.

National has a track record of stability and, incredibly for a third-term major party, has shown very few cracks in caucus unity.

If the past state of the economy has been positive – particularly if it has got better – early deciding voters use this to predict future trends.

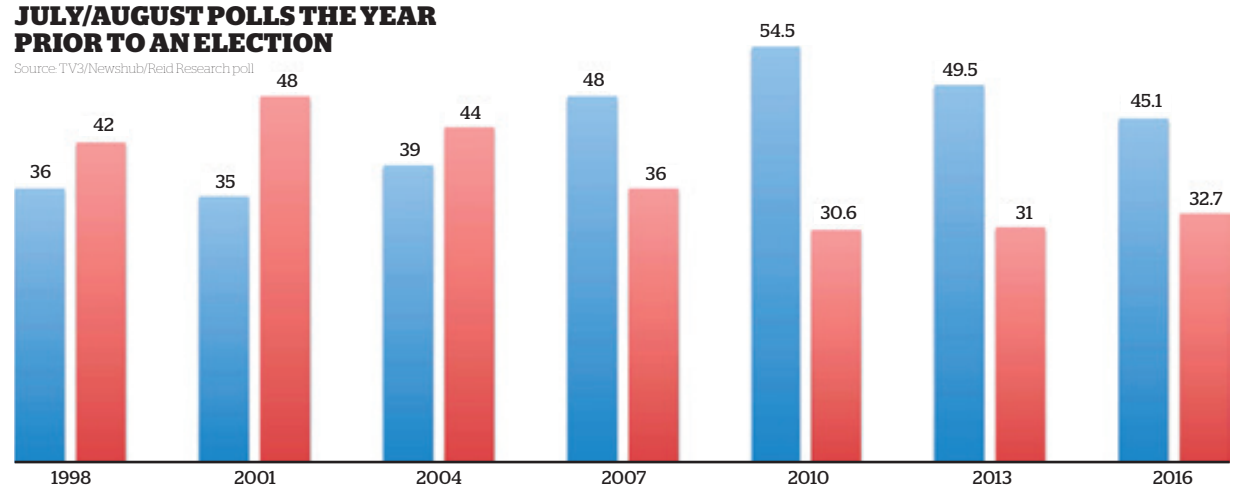
Economic indicators are still largely positive, aside from rampant house price inflation and lack of supply in Auckland.

With a voter base that is predominantly comprised of homeowners whose asset values have risen, however, National voters will not be wanting or predicting the economy to tank between now and election day 2017.

Labour-leaning early deciders face a lot more unknowns, ranging from Labour's new vision and policies to whether Andrew Little has what it takes to be the next Prime Minister.

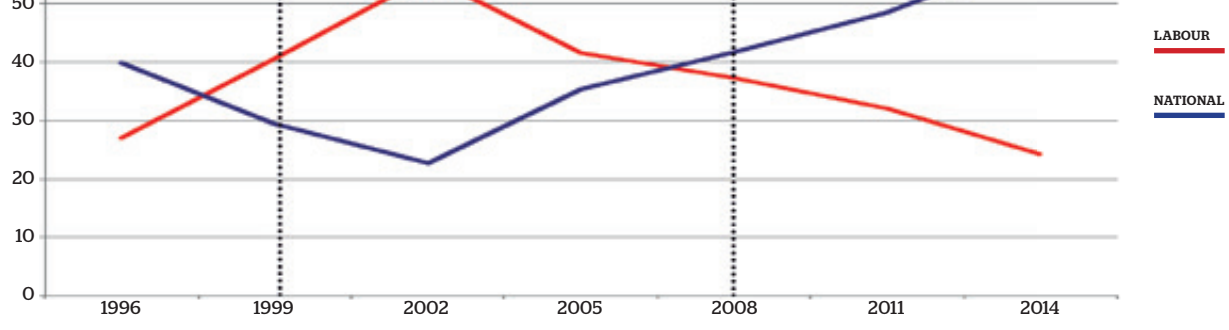
JULY/AUGUST POLLS THE YEAR PRIOR TO AN ELECTION

Source TV3/Newshub/Reid Research poll



PROPORTION OF EARLY DECIDING VOTERS

Source New Zealand Election Study



It takes time to build credibility as a political party leader. Jim Bolger and Helen Clark were leaders of the Opposition for 4.5 and six years respectively before becoming Prime Minister.

John Key was leader of the National Party for just under two years before he became Prime Minister, but the opinion polls had already switched in National's favour when he took on his leadership role.

Also working against Labour's ability to secure the early vote is the 31 May Labour/Greens agreement to build a basis "of a stable, credible and progressive alternative Government". It is a commitment to being more cooperative in the lead-up to the election, but it's not an offer of a coalition government and voters have to wait to see what it really means.

Labour might be thinking it has a bit of time up its sleeve. After all, only two-thirds of Labour's supporters reach their vote decision this far out from the campaign; the other third wait until the campaign to reach their decision.

But Labour will have to work hard for the late deciding vote.

On average 41 per cent of voters who reach their decision during the campaign give their vote to a minor party. The next highest cohort (31.9 per cent) give their vote to the major party that ends up winning the highest proportion of the party vote. Labour hasn't won the majority of the late deciding vote since 2005.

It is also by no means guaranteed that joining forces with the Greens will see their combined vote rise. Late-deciding Labour and Greens voters tend to "eat each other's lunches".

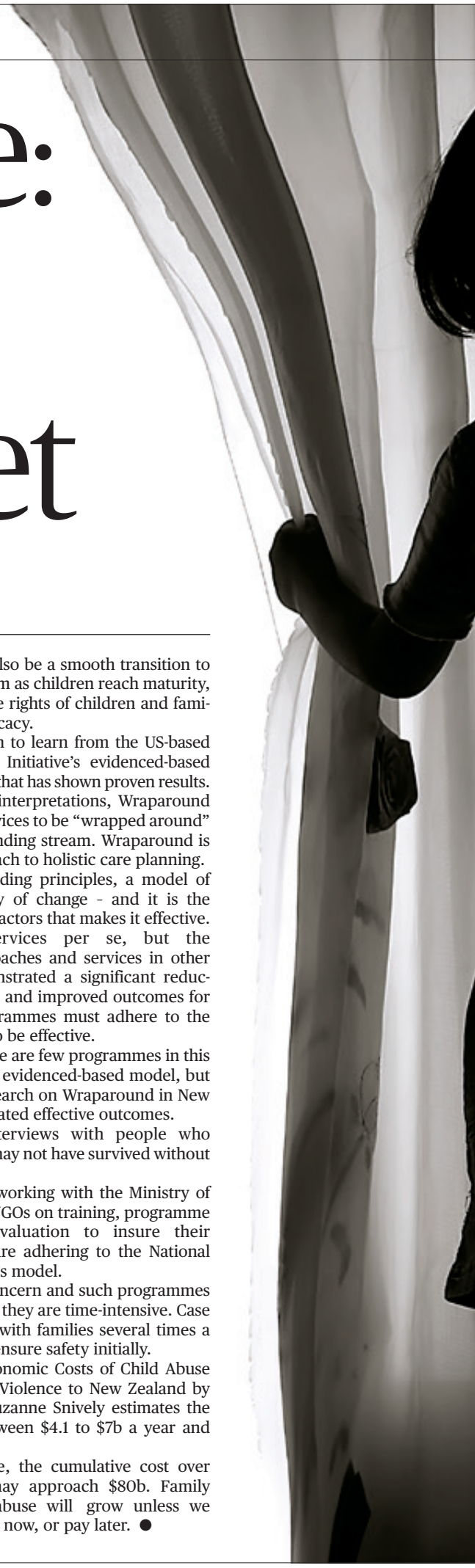
In other words, when Labour's late-deciding support rises, the Greens' support falls and vice versa.

To be in a position to replace National, both Labour and the Greens need to attract late deciding voters away from National and New Zealand First.

This will happen, but not until Labour is in position to switch places with National in the year before the election. Because this did not take place in 2016, history suggests we are at least two years away from Labour trading places with National in the opinion polls and four years before Andrew Little becomes Prime Minister. ●

SOCIAL ISSUES

Family violence: New Zealand's dirty little secret



Will the new Ministry of Vunerable Children, Oranga Tamariki, be enough to overturn this country's plague of child abuse?

Dr Ruth Gammon
Senior lecturer and the director of the Wellington Psychology Clinic at the School of Psychology at Massey University. She leads research in the area of Wrapround in New Zealand

New Zealand presents itself to the world as pristine and beautiful – 100% Pure, with snow-covered mountains, crystal-clear rivers and dolphins playing joyfully in our oceans.

But behind the billboards is another reality: our people suffer one of the highest rates of family violence in the world.

New Zealand has the fifth worst child abuse record out of 31 OECD countries. On average, one child is killed every five weeks. Most are under five and 90 per cent are killed by someone they know.

Studies have estimated one in four girls aged under 15 have been touched sexually or made to do something sexually they did not want to.

At least one in eight boys have experienced sexual abuse (although the rates are likely to be much higher, as sexual abuse among boys is still under-reported).

Of real concern is the rate for Maori girls – twice the rate of European or other ethnicities. Currently, more than 5000 children are in the care of the Ministry of Social Development, with more than 4000 children living in 'out of home' placements.

Both these statistics increased by 6 per cent in the last fiscal year.

The statistics for intimate partner violence are grim too. New Zealand continues to rate among the worst countries for this, with one in three New Zealand women reporting having experienced physical and/or sexual intimate partner violence.

When psychological/emotional abuse is included, it jumps to over half. Stories regarding women being murdered by their partner or ex-partner continue to grab headlines too frequently. Approximately half of all homicides and more than half of all reported violent crime in New Zealand is the result of family violence.

Often, intimate partner violence is seen as a problem of lower socio-economic groups, or the result of poor education, but the statistics do not support this.

A recent study found 26 per cent of women living in homes with a household income over $100,000 a year, and one in four women who have a university degree or higher education had experienced physical or sexual violence from an intimate partner.

Despite the relentless pain, suffering and long-term trauma these statistics represent, family violence is treatable and preventable. But appropriate resources and funding are needed.

In recent press releases announcing the new ministry Oranga Tamariki (which I prefer to use as it is a more appropriate name than Ministry of Vunerable Children) calls for a more comprehensive, coordinated approach.

But do they have the models needed to make this happen? New Zealand does not yet have a 'system of care' – a comprehensive spectrum of multi-dimensional services that are organised into a coordinated network to meet the multiple and changing needs of children and families.

A system of care could address the gaps in services in New Zealand because it is based on core values, rather than a defined programme.

The core values for such a system are: child-centred and family-focused; responsive to the needs of the child and family; community-based, and culturally sensitive.

But it will take more than simply giving Child, Youth and Family another facelift.

Services need be comprehensive and integrated. They need to be equipped to address the physical, emotional, social and educational needs of the child and family.

They must involve families and whanau in all aspects of planning and delivery, have effective case management, and early identification and intervention.

Then there must also be a smooth transition to the adult service system as children reach maturity, with protection for the rights of children and families and effective advocacy.

There is also much to learn from the US-based National Wraparound Initiative's evidenced-based model of Wrapraound that has shown proven results.

Contrary to local interpretations, Wraparound is not a package of services to be "wrapped around" families, nor is it a funding stream. Wraparound is a philosophical approach to holistic care planning.

It has specific guiding principles, a model of delivery and a theory of change – and it is the combination of these factors that makes it effective.

It's not the services per se, but the process. These approaches and services in other countries have demonstrated a significant reduction in family violence and improved outcomes for youth. But such programmes must adhere to the fidelity of the model to be effective.

Unfortunately there are few programmes in this country following this evidenced-based model, but Massey University research on Wraparound in New Zealand has demonstrated effective outcomes.

This includes interviews with people who believe their families may not have survived without such services.

We are currently working with the Ministry of Education and other NGOs on training, programme development and evaluation to insure their Wraround services are adhering to the National Wraparound Initiative's model.

Cost is always a concern and such programmes are expensive because they are time-intensive. Case managers often work with families several times a week to stabilise and ensure safety initially.

Measuring the Economic Costs of Child Abuse and Intimate Partner Violence to New Zealand by Sherilee Kahui and Suzanne Snively estimates the economic cost as between $4.1 to $7b a year and rising.

If nothing is done, the cumulative cost over the next 10 years may approach $80b. Family violence and child abuse will grow unless we address it. We can pay now, or pay later. ●

Family violence and child abuse will grow unless we address it

The gender (r)evolution

More and more people are discovering the gender they were assigned at birth is different from how they experience their identities

Associate Professor Mark Henrickson
Researcher on HIV and sexual and gender minorities with Massey University's School of Social Work

Boy or girl? This is the first question that is asked about most of us, often before we are even born.

The answer to that question can shape our entire lives – the clothes we wear, our education, our career options, our incomes, our relationships, and of course which public facilities we use.

Our ideas about boys and girls, males and females are handed down from generation to generation, yet we rarely stop to think about where they come from.

Of course there is the obvious biological answer – males are the ones with dangly bits that can impregnate, females are the ones with internal bits that can give birth.

But some people are born with anatomy that requires interpretation in order to answer that question, and surely our lives are about much more than reproduction.

Over the past century and more we have been rethinking what we mean by gender. New Zealand was at the forefront of this as the first country to give women a vote; previously this had been a men-only club.

Women have moved into the workplace and men have moved into domestic roles. Even gender roles on marae have been reconsidered. In New Zealand gender role evolution is incomplete, but it is happening.

As we move beyond the gender binary – that is, beyond thinking about people as only male or female – more and more people are discovering that the gender they were assigned at birth is different from how they experience their identities.

In New Zealand 1.2 per cent of high school students describe themselves as transgender and 2.5 per cent say they are not sure of their gender.

If we conservatively estimate one-quarter of a million secondary students in New Zealand, that's a lot of young people who have decided the answer to the boy or girl question was either wrong, or inadequately described them.

Yet people who live beyond the gender binary are not safe in most places around the world.

From 2008 to 2015, more than 2000 transgender people were murdered in 65 different countries, an epidemic of violence recalled each Transgender Day of Remembrance, November 20.

We can think about safety in lots of different ways, but surely the right not to be killed simply for being you is an important one.

According to Human Rights Watch, trans and intersex people routinely report being turned down for jobs and housing because how they present themselves does not match their documentation.

Just recently a Samoan newspaper ran a photograph of the body of a transwoman who had committed suicide, and repeatedly referred to her with the wrong pronoun, adding indignity and humiliation to an already tragic situation.

Transgender people are more than simply "born in the wrong body". Transgender has become an inclusive term that describes people who are neither male nor female, or both male and female, or who fall somewhere on the continuum between male and female.

Not all transpeople will undergo gender realignment surgery. In fact, many will not take that step, which is not surprising since the wait for gender realignment surgery for New Zealanders is now as long as 44 years.

Most of us will have encountered celebrity transpeople by now, but few of us realise how many transpeople we encounter in our daily lives, because they simply want to get on with life without drawing attention to themselves.

Fortunately, we have come some way in creating equal spaces for transpeople. We now have the option of an undeclared gender on passports, and in 2018 the Census will recognise that New Zealanders are gender diverse. There has even been a trans character on Shortland Street played by a transperson.

There are also some efforts being made to create safe spaces for transpeople. A small number of schools have introduced gender-neutral toilets for their students and a few councils have designated unisex or gender-neutral public facilities.

But only Britain, Bolivia, Ecuador, Fiji and Malta have guaranteed protection for transpeople in their constitutional frameworks.

New Zealand does not yet do that. While legal protections are a good start, even more important is the ability of every single New Zealander to open their heart and mind. ●

TECHNOLOGY

Reaching for the stars

For the first time young Kiwis can see tanglible prospects in the space industry. New Zealand's future as a space nation looks bright

Johan Potgieter
Associate professor in mechatronics, additive manufacturing and robotics in the School of Engineering and Advanced Technology at Massey University

New Zealand is on the verge of entering the space race. Auckland-based company Rocket Lab will launch its first test rocket from its site on the Mahia Peninsula by the end of the year; in another year it should be ready to make its first commercial flight.

When Rocket Lab begins taking satellites into orbit around Earth, it will be from the world's first privately-owned launch pad. But the government sees the potential too – as the newly-formed New Zealand space agency, which sits within the Ministry of Business, Innovation and Employment, shows.

So much of the hype around the 'space race' is about tourism, but taking people for space joyrides isn't the main opportunity for New Zealand. That rests with the technology and know-how that clusters around the launching of satellites and other materials into space.

The fact that we are seen as a small island in the south Pacific with some excellent niche capabilities is our unique selling point.

We are smart, innovative people and the fact that we're far away from the rest of the world is now an advantage. New Zealand is a good place to try things, a place where not everyone is watching.

Some large, commercial space engineering companies are looking very keenly at New Zealand for the testing and evaluating of products.

We are a good option if you don't want to trial new space technologies in the US around your competitors.

There is also no reason why New Zealand cannot establish itself as the 'Switzerland of the space industry' – a safe haven for launching security network infrastructure, for funelling big data and conducting scientific research.

We could be the non-aggressive, non-military player whose space platforms are used for the betterment of mankind.

With the right investment and vision, I can see New Zealand becoming a cost-effective centre for space research: materials testing, atmospheric and environmental research, better weather and natural disaster predicting, building communications infrastructure, or simply improving our understanding of the conditions in space.

We could set up unmanned mini-space labs for hire. Scientists could send small boxes up into space, with the ability to conduct experiments that are controlled and monitored from Earth.

Suddenly, scientists will be able to test chemcial reactions in ways we have never done before in a zero-gravity environment.

Add to this a thriving space tourism industry and you can begin to see the value of this industry to New Zealand.

This is not about sending people into space, but catering for the many space enthusiasts who will pay big money to be around the space industry and see a rocket launch.

New Zealand already has a very successful tourism industry, but this would attract a very different demographic: the high-tech tourist.

Wealthy, tech-savvy people from around the world will pay large sums of money for such a unique experience. And once you get those leading tech entrepreneurs and engineers in the country, the opportunities multiply.

Suddenly all sorts of connections are being made between international tech sector executives and local companies, entrepreneurs and scientists. That creates an ecosystem for the region, with New Zealand at its centre.

All this means, for the first time, Kiwi kids can consider going into the space industry as a viable career path. They see visionaries like Peter Beck from Rocket Labs reaching out for space – and it's not just a pipe dream anymore.

Kids are already learning about rocketry in high school – during the last school holidays Massey University partnered with Kiwibots, KiwiSpace and Aerospace Education to run the Rocketry Boot Camp for Year 7 and 8 students.

When Rocket Lab's Electron reaches for the stars, it will also launch the dreams of many future rocket scientists.

One day soon those students may be able watch a web stream of a New Zealand science experiment being conducted in space, in real time. At that point they will understand something crucial about their future career: space is not just a destination; it is also a tool.

And that's the sort of space race New Zealand can really compete in. ●

TECHNOLOGY

The science of virtual reality

Virtual reality is on the cusp of breaking through as a mainstream technology, but there's still a way to go before being in a virtual environment is a seamless experience

Virtual reality. Most of us have heard of it, many of us have tried it, but only a few of us use it regularly.

That could be set to change with a range of devices and headsets now available at achievable prices.

These include Facebook-owned Oculus Rift and HTC Vive at the upper end of the market, and Samsung Gear VR and Google Cardboard, which turn a smartphone into a VR device, at the cheaper end. Sony is also in the mix with a PlayStation VR headset for its PlayStation 4 console.

These VR headsets are more than just stereoscopic displays like a 3D television or movie screen.

Stereoscopic displays create the illusion of depth by presenting to each eye an image of the same scene from a slightly different perspective. The closer an object is, the greater the difference in the image each eye receives, and that difference allows our brains to determine how far away the object is.

Dr Daniel Playne
Lecturer at Massey University's Institute of Natural and Mathematical Sciences

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

While these screens create a sense of depth, they are still an external display within the viewer's environment.

Virtual reality, on the other hand, replaces everything we see with a virtual environment. This is commonly achieved with a head-mounted display equipped with a range of sensors and trackers that determine the orientation (and sometimes position) of the user's head.

The headset then renders a view of the virtual environment from the user's perspective onto its screen.

Presence is the word used to describe the experience of feeling you actually exist within a virtual environment.

This sense of presence is behind many of the extreme reactions users display during VR demonstrations.

People can subconsciously lean in an effort to maintain their balance on a virtual rollercoaster or flinch in order to avoid a virtual threat.

This is why VR delivers such a powerful experience, but it also presents a problem: users tend to forget their existence in the real world.

Their reactions to virtual stimuli can cause damage to the equipment or, worse, injury to themselves or others.

If it is implemented safely, a strong sense of presence can provide a high level of engagement and help developers immerse a user in their application.

For games developers it provides an opportunity to create a more entertaining and immersive game that transports the player to another reality where they no longer just control a character, but start to become the character.

This level of immersion opens up other applications for VR technology, including education and training.

Educational projects already unveiled include the British Museum's use of VR to take visitors back to the Bronze Age or an experience that allows visitors to London's Natural History Museum to explore the Earth's prehistoric oceans, with commentary by David Attenborough.

Training for jobs where mistakes may be costly or dangerous is another possibility.

Giving users a sense of presence means they not only learn to deal with the task at hand, but also their own subconscious reactions and fears.

The use of VR in therapeutic applications could allow users to address their fears in controllable doses and environments.

But are our bodies ready for this new technology? There are a number of factors that contribute to presence, or detract from it and the technology has some challenges to overcome.

The display frame rate (number of images the device can display per second), resolution (number of pixels) and latency (the delay between the user performing an action and that action being reflected by the virtual environment) have a direct effect on the quality of the experience.

Low resolution or frame rate or high latency reduce the sense of presence and are thought to contribute to virtual reality sickness (or cybersickness) – the symptoms of which are similar to motion sickness.

While issues around these factors have largely been addressed, we are still waiting for developers to create new techniques for representing the user's virtual body in the virtual environment.

This can be tricky, with many applications currently displaying nothing and giving users a sense of being a disembodied head floating through the world.

The other key challenge is to overcome the user's awareness of movement. There is a disconnect because their eyes tell them they are moving through a virtual environment, but their other senses tell them they are sitting or standing still.

This difference between the sense of motion in the real and virtual worlds is another contributor to cyber-sickness.

As a result, VR headsets currently come with warnings about nausea, eyestrain and headaches. It's only when these issues can be resolved that the mainstream take-up of VR can really take off. ●

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