



NUFFIELD
NEW ZEALAND

*Global Vision, Leadership
and innovation in Agriculture*

The Innovative Farmer

Generating innovation through a farmer and grower-led system of innovation



Mathew Hocken
Nuffield Scholar 2017



Foreword

The Nuffield experience is all about the opportunity to see, hear and explore challenging ideas and concepts that cause the traveller to pause and think. I don't think Mat has done much pausing, but this report abounds with challenging thinking.

The Nuffield experience needs to be open minded, inquisitive and often quite scary to ensure that this opportunity is more than a passing thought consigned to distant memory. The opportunity to have time and space to share thoughts and ideas in different geographies and across language and ethnic barriers is the essence of the Nuffield value proposition.

For scholars to be successful and for Nuffield to continue to provide opportunities, scholars must be able to demonstrate that they have embraced the challenge and have used the time and space to think differently and creatively about improving the future of agriculture and agricultural communities. This report is an excellent demonstration of just that.

Mat has grasped the opportunity with enormous energy and passion as readers will easily see. Importantly he has created an opportunity and a call to action for those who are prepared to lead and innovate. It's great to see that modern Nuffield is alive, well and thriving.

John Palmer
Nuffield Scholar 1989

Acknowledgements

Looking back on the last year I feel very fortunate and grateful to have completed a Nuffield Scholarship. While I had a clear plan of what I wanted to see, who I wanted to visit and where I wanted to go, at the outset of my travels I took the attitude to say “yes” to everything and let serendipity play its part. I really wanted to embrace the experience and learn as much as I could. That led me to a number of interesting insights and some great experiences.



Thank you to our Nuffield NZ strategic partners and programme partners. Your investment in me has made a huge difference in my life and I believe this past years’ experience, as well as the ongoing interaction with the Nuffield network, will enjoy compound growth over the coming years.

I would like to say a personal thank you to Juliet Maclean and the Nuffield Board Trustees, as well as Anne Hindson, Desley Tucker and Lisa Rogers. You made me feel very welcome in joining the Nuffield family and have been a great support throughout my scholarship. Thank you to Nuffield International, Sally Thomson and her team who ensured we started our Nuffield journey with a bang at the CSC conference in Brazil. It was real privilege to be in the room with 70 agriculture leaders from around the world. Thank you also to Nuffield Australia for organising an amazing Chile GFP group tour. It was a real pleasure getting to know the group as we travelled together for six weeks and this experience has given me nine life-long friends.

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A huge thank you to our team on farm who achieved outstanding results while I was away, especially my Dad who “kept the wheels” on as he would say and encouraged me to do a Nuffield. To my Mum and sister Heather thank you for supporting me and helping with our girls.

And finally, a very big thank you to my wife Jana and our two young daughters Annabelle and Gabrielle. I know it was not always easy, but we got through it and it was an incredible experience that I know will enrich our lives for many years to come. Thank you to Jana for your invaluable help with this Report and your work with the team while I was away; everyone wants a Visual Management Board now!



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Prologue - What is a Hackathon?¹

We stood in a circle at the cowshed. It was a cool November day but there was energy and animation emanating from the group. Half a dozen farmers, a couple of Massey University lecturers, Microsoft representatives from NZ and overseas, our local accelerator the BCC and Malcolm Fraser from the Jump-start program were gathered. Talk around the circle bounced between the challenges and dreams of farmers and technical ideas for solving them.

Malcolm interrupted the chatter: “This needs a hackathon.” What the hell is a hackathon I thought to myself. “Yes, a hackathon,” he repeated. “We’ll get teams from schools, universities and start-ups to ‘hack’ these problems. They will work on it over an intensive week and at the end they pitch their ideas dragon’s den style to a panel of judges. The team with the best idea wins the competition and prize-money, as well as the opportunity to attract funding to progress their idea. It gets people collaborating, inspires new thinking and the possibility of coming up with the next big idea.” Starting to get an idea of what this was all about, James said “yeah, we will get the techies out from behind their computers and onto a farm so they can see and experience themselves what goes on.”



Figure1: Hackathon teams on James Stewart’s farm, Manawatu, March 2017

We gave ourselves a 90 day deadline and got to work with focus and energy. It was lean and mean; we (the farmers) didn’t know much about how it would all work, but in consultation with Federated Farmers and Beef and Lamb, we came up with eight on-farm problem statements to be hacked, from real-time

¹ <https://www.hackathonmanawatu.nz>



grass measurement, to managing water supply, to weighing animals in the paddock. Malcolm and Massey University provided direction. Microsoft provided the platforms and advice, BCC with help from CEDA organised and promoted the event.

Fuelled with caffeine and sugar, hackathon teams took on the challenge of coming up with solutions to one of the problem statements. We had them out on farm and they worked in the lab. With a bit of arm-twisting local farmers got involved to be farmer-mentors for each team. While initially reluctant, after a little time with the hackathon teams, they came back buzzing, seeing the energy and creative thinking going into solving their on-farm problems.

The hackathon was an example of a bunch of farmers getting together and thinking about the frustrations they felt as they walked around their farms. Problems that had not yet been solved. Pressures that had been mounting from the public. Things that would drive productivity, or reduce costs, or enable them to farm more sustainably. It also enabled them to articulate some of their dreams. It was farmer driven. It drew on the best and brightest from other sectors. It drew on experts who could bring together networks of people to collaborate. It drew on technology to provide the platform to make it all possible.

For me the hackathon was an enlightening moment. It showed me that as a farmer I could actively and directly get involved in generating ideas to solve on-farm problems. It showed the power of collaborative networks to generate new ideas and drive fast-action. It also opened up to me the idea of an innovative consciousness; that the people changing the world today are thinking in quite different ways and that we need to change our thinking. It inspired in me the direction for my Nuffield study tour.



Executive Summary

The genesis for my Nuffield Scholarship research was a sense that farmers and growers have a number of significant challenges or problems, both on-farm and off that have not been solved, or we are struggling to solve. As we milk, shear, tend and harvest, thousands of farmer and grower-minds around the country turn to these problems and to the dreams we have for the future.

We think about our immediate problems, like how much grass have I got to feed my animals, or do I have a water leak? We think about system problems, like how will I reduce my nutrient use, or what is my environmental footprint? We think about the tough problems like changing consumer preferences, or heightened society expectations and how can we reconcile these. Collectively we think and dream of a hundred thousand ideas. At the moment very little happens with many of these ideas. I want to change that.

In this Report I refer to the *Wicked Problems* of agriculture and food. These are the complex, incomplete, and changing problems we face, where there are no black and white answers but rather trade-offs. And often when a solution is found to one problem, then another problem emerges. Producing nutritious food for a growing population, with less agricultural land, a smaller environmental footprint, climate change and satisfying a multiplicity of consumer demands, while improving livelihoods for rural communities is a wicked problem.

In NZ we have many of the pre-conditions for innovation and fare comparatively well on international innovation indexes. So, what is missing? Why are we struggling to solve the wicked problems we face? The problem is two-fold: firstly the very-nature of the problems we face needs to be recognised; they are wicked problems and we cannot solve them alone. Working away in isolated groups won't do it. Rolling up our sleeves and puffing out our chests to declare we will solve it won't do it. And well-intended broad consensus collaboration won't do it. Secondly, we need to take a closer look at our system of innovation. Where is the user (the farmer and grower) in our design of innovation, where is the user in the generation and development of innovation? How do we close that gap, refine our innovation and speed our cycles to market?

This Report aims to provide a model for generating and capturing ideas to solve the wicked problems of food and agriculture. The key element to solving this is bringing to bear the focus, passion, practical application and entrepreneurial drive of our farmers and growers. The innovation model needs to put them at the centre. It also needs to build an innovation consciousness amongst our farmers and growers.

This topic is important because the world today has become much more complex, uncertain and fast-moving. I borrow the term VUCA (volatile, uncertain, complex and ambiguous) from the military to throw light upon this. To succeed and innovate in this VUCA world we need to be actively engaged in innovation to perceive the opportunities and foresee the risks of disruption to our businesses and industries. As Rodd Carr, Vice Chancellor of University of Canterbury explained, "the lone-farmer standing in the field is a high-risk strategy."

Generating ideas is the easy part. Ideas sitting in silos by themselves are useless. We need platforms to take one good idea and, as Stephen Johnson in his book *Where Good Ideas Come From* describes, *collide* it



with another good idea to create innovation.² We need places where good ideas can be shared, refined and given substance. In this Report I look at case study examples of platforms for innovation from Salinas Valley in California, from the Netherlands, from the EU and from Silicon Valley.

This Report recommends an innovation model for New Zealand where farmers and growers *lead from the middle* to solve the challenges they face. I describe eight principles of innovation to assist farmers and growers understand what good innovation looks like. I explain the myths, barriers and wrong-turns to innovation, to help navigate along the zig-zag path of innovation.

I make the following recommendations in this Report:

- 1.) Place farmers and growers at the centre of innovation in the agriculture and food sectors. Design and stand-up collaborative networks that engage with consumers and society for sustainable and value creating innovation. Developing ways to connect with consumers and society that demonstrate transparency, build trust and show value are critical areas.
- 2.) Promote an eco-system approach to innovation. Innovation will flourish when parties each benefit and contribute to the innovation. This might be in the form of solving a problem, developing a product, or service offering, generating data, or showing the way to the next wave of innovation.
- 3.) Remove all barriers that discourage people from engaging in innovation. For example, in the EU they took away the 'phone book' size application for innovation grants and introduced a dragon's den style application, which created more interest and was accessible to innovators and entrepreneurs.
- 4.) Invest at the project-level for innovative ideas and do not over commit resources to management and reporting layers. We have limited resources and we must apply them to actual work. Visions of the way the world should be will not get us there.
- 5.) Promote the adoption of an innovative consciousness. Generate new ideas and collide them with others. This is more than the number 8 wire approach and requires the adoption of a principles-first attitude to what is possible. Real change occurs when there is a social and technological innovation. If we think throwing new technology will solve our problems we are mistaken.
- 6.) Promote open collaboration between regionally based centres of innovation, and international innovation centres in US, Netherlands, Israel, Chile, Ireland, UK, Brussels and Australia. The issues are national and international, as are our consumers as well as pressure groups.
- 7.) Actively engage people from other sectors. There is often innovation on the edges between sectors and the cross-pollination of ideas and methods.
- 8.) Understand the time horizons of innovation and what is required a.) now to remain competitive and stay in business, b.) what is the third horizon opportunities c.) what is the second time horizon innovations required to build skills, expertise and products to grab the opportunities of the third time horizon

² S Johnson, *Where good ideas come from: The Natural History of Innovation*, 2010.



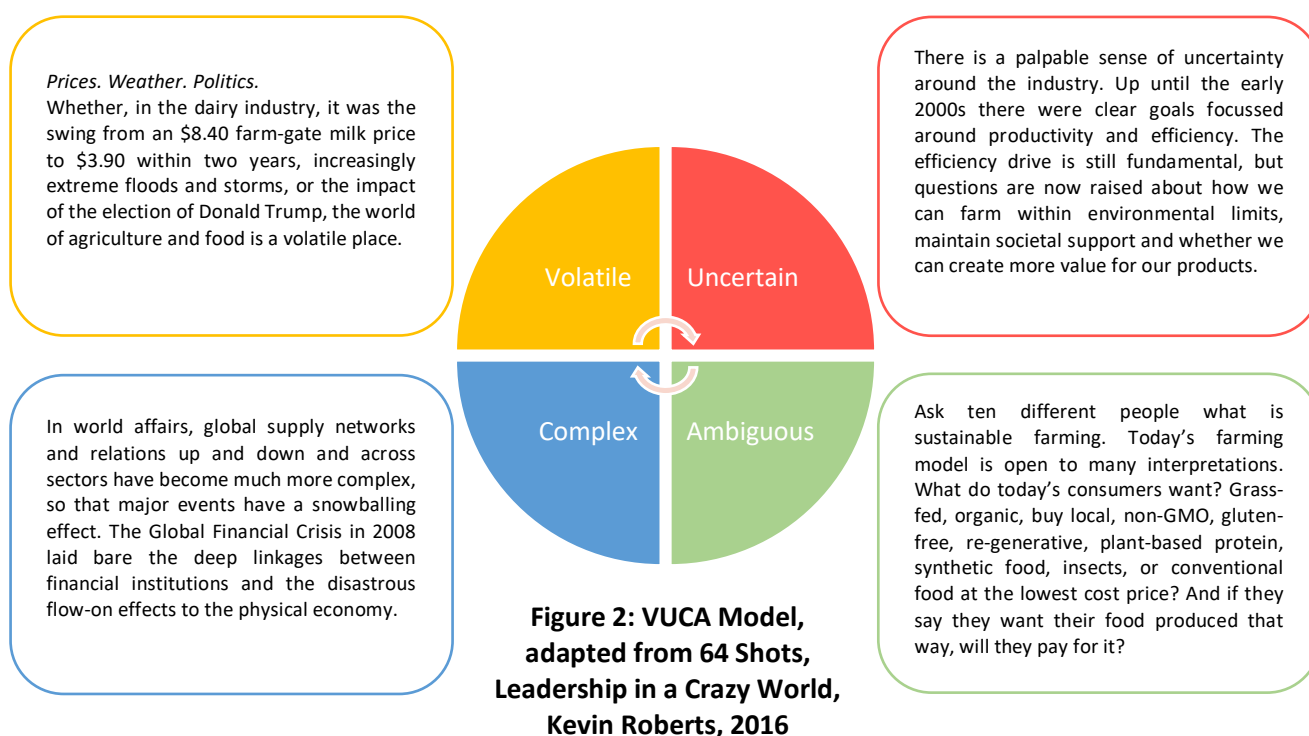
The model is built on open innovation principles and encourages the exchange of ideas and participation of groups across society. It must be agile and work with speed to generate tangible outcomes. I have developed my recommendations based on principles that are robust and fit for the NZ cultural context. It is designed to work locally and network nationally and internationally.

Finally, I have described the journey that myself and a group of farmers and growers from the Manawatu have embarked on. We are creating a collaborative innovation network. It has been an exciting time for us and there is a real sense of optimism and momentum building not only in the region, but up and down the country. I look forward to colliding ideas with you!

1. Introduction

Why do we need to innovate?

We live in an age of disruption. Companies, business models and whole industries are being up-ended at a faster rate than ever before. In 1920 the average lifespan of a company on the S&P 500 index was 67 years; today it is 15 years. Kevin Roberts borrows the military term VUCA (volatile, uncertain, complex, ambiguous) to describe the world we live in today.³ As a former Chairman and CEO of Saatchi & Saatchi the global advertising agency, he lives in a world that by any person's description is a hectic, fast changing place, but it is also a fitting description for the world of agriculture and food.



Farmers with weathered faces, who have seen a drought or two, lived through the 1970s oil shocks, the great de-regulation and interest rates hikes of the 1980s, might give a wry smile and say, “look here, we’ve had what you call VUCA since Adam was a cowboy.” And they would be right. VUCA has been operating at differing levels throughout time. However, there are important differences today. The speed, global connection and potential for technological disruption that is rapidly transforming industries is new.

I went to the *Food IT: Farm to Fork* conference in Mountain View, in the heart of Silicon Valley and listened to an interesting presentation by Michiel Bakker, Google’s head of global food services. Bakker described the problems in agriculture and food systems as *wicked problems*. He said a wicked problem has complex,

³ 64 Shots. Leadership in a Crazy World, Kevin Roberts, 2016



incomplete, changing and contradictory elements. There are no black and white answers but rather trade-offs. And often when a solution is found to one problem, then another problem emerges. Producing nutritious food for a growing population, with less agricultural land, a smaller environmental footprint, climate change and satisfying a multiplicity of consumer demands, while improving livelihoods for rural communities is a wicked problem.

If the future is uncertain and you face a set of wicked problems, what would you do? Just blindly plod along to tomorrow, knowing it was going to be very different from today? Or would you prepare yourself as well as you could? Would you embrace the opportunity to disrupt, create, or revive a business model or industry sector? Would you be working hard to come up with new ideas. Would you be innovating?

What is the problem?

New Zealand has many of the hallmarks of an innovative country. We place well on international comparisons of innovation. The 2017 Global Innovation Index ranks New Zealand 21st, ahead of Australia and China.⁴ We have universities and researchers comparable to the best in the world. We have efficient farmers and growers. We have some large, internationally successful companies and cooperatives, we have good digital adoption and a growing start-up scene. And we have many great individual success stories.⁵ So, haven't we got it covered? Aren't we the kings of *number 8 wire* ingenuity?⁶

However, productivity across the board in New Zealand is relatively low.⁷ On New Zealand dairy farms productivity has not increased over the last 10 years.⁸ That means while we have grown total production, we are not getting any better at turning total inputs into total outputs. We do not just face a productivity problem. We face a societal-support problem, where the way we farm and what we farm is under increasing public scrutiny. Even when we look on-farm, our farmers and growers still face many of the problems and challenges they did thirty years ago.

We have relied on industry and company research and development (R&D) and extension to generate and disseminate innovations throughout the industry. This has been successful particularly in the areas of animal and plant genetics, pasture management and efficient production and processing. We have managed this off a comparatively low level of investment.⁹ However, even if we increase investment in R&D (which we should) this top-down model is under pressure around the world due to the speed of technological advancement, the complexity of a globalized economy, and consumer and society demands around transparency, environment and sustainability. In this context, no one-person, business or institution has all the answers. In fact, the lone researcher, institution, company, or even industry is now

⁴ <https://www.globalinnovationindex.org/gii-2017-report> The Global Innovation Index 2017

⁵ See the excellent website NZEdge.com for examples of NZ companies and people succeeding around the world <http://www.nzedge.com> I met with NZEdge founder Brian Sweeny in New York who is a passionate advocate for NZ and a great communicator.

⁶ For non-NZers please see glossary for definition of no.8 wire ingenuity

⁷ <http://uat-productivity.samdog.co.nz/sites/default/files/BIM%202017.pdf> Productivity Commission briefing to incoming Minister 2017,

⁸ DairyNZ Economic Survey 2015-16, <https://www.dairynz.co.nz/media/5787208/dairynz-economic-survey-2015-16.pdf>

⁹ New Zealand's total investment in R&D is only 1.3% of GDP, which is half the OECD average. Recently the Minister of Finance, The Hon Grant Robertson focussed on this issue in a speech which referenced the OECD conclusions about New Zealand: "Expenditure on R&D is low as a share of GDP, most notably in the business sector. Collaboration between firms, education and research institutions is low."

<https://www.beehive.govt.nz/speech/speech-productivity-hub-future-work-adaptability-resilience-and-inclusion>

at greater risk of missing the next big thing that may be an opportunity or a disruptive threat. Therefore we can no longer rely solely on this form of innovation in the future if we want a thriving agriculture and food industry and to position ourselves at the leading edge internationally. The aim of this Report is to show that there is a way of tackling these problems. That we can improve our productive performance and position ourselves as a country that is genuinely at the top of the league tables for innovation.

What do we need to do differently?

When you think about innovation, you might think of a crazy inventor shouting “eureka” as he discovers the secret to what he is seeking. Or you might think of the researcher in her lab coat, pipette in hand, pouring over sample results in a laboratory. Or the Silicon Valley wunderkind *wired-in* to his laptop writing code. What I have found is that today, if in fact it were ever true, successful innovation is quite different.

Innovation is about solving problems by those closest to them. It is increasingly about collaborative networks of people forming and providing spaces for ideas to collide. It is about engaging our supporters and our detractors in the innovation process. It is about generating an innovation eco-system where participants benefit from each other’s activities. It is bringing people together to share ideas much more systematically than we have ever done before.

Below are three famous innovators: Jethro Tull, William Morris and Elon Musk.¹⁰ The blank photo is not a mistake. I left it there for you. To add your photo. If you are with me to here, you can cut and paste your photo there (either physically with scissors and glue, or do it electronically if you are reading on your PC). If you are not into that and I’m working on a slow-burn with you, just visualise your portrait in that photo box for now. I’ll come to you at the end of this Report with a challenge and that’s when you have the chance to share your ideas.



Figure 3. Innovators

¹⁰ Jethro Tull helped bring about the British Agricultural Revolution by perfecting the horse-drawn seed drill. William Morris, also known as Lord Nuffield was a car manufacturer, who owned the Morris Motorcar Company, and later philanthropist. Elon Musk is the founder and CEO of both Tesla electric cars and SpaceX, a private rocket company

2. My focus on innovation

I have spent the last 12 months on my Nuffield scholarship studying innovation. I've conducted hundreds of interviews, visited dozens of farms, supermarkets, universities, processors, companies, accelerators, R&D laboratories, government agencies and departments, ministers and members of parliament. I visited 14 countries with a focus on the US, Europe and Israel.

During that time I read numerous articles, books, watched many TEDTalks and YouTube videos on innovation, read blogs and attended three Agtech conferences. I took detailed notes of interviews and kept a travel diary. I have sought to immerse myself in the subject matter and push myself to look deeply into innovation.

Before I set off on my travels Alison Watters, LIC Board member and innovation expert offered me the following sound advice, "Don't try and boil the ocean." Innovation is a broad concept, don't try and cover everything. There are 6.6 billion results on a google search of innovation. The term innovation is applied so broadly that it can become a cliché and does not lend itself well to pithy description.¹¹ Innovation can be fluid, even messy; it can be incremental, transformational or disruptive; open or closed; and serendipity often plays a vital part.

This Report does not attempt to try and cover every aspect of innovation. I do not seek to cover corporate R&D, or the government role in innovation, although I do make comments relating to both, and I hope that those two sectors will take some interest in my findings. My focus is on that part of innovation, which I think can have an outsize effect on it; and that is how to inspire farmers to join and drive collaborative innovation networks.

Innovation and Agtech

Agtech is a widely-used term to describe technological innovation in agriculture and food. I have deliberately used the term innovation in the title, rather than (the increasingly common) phrase Agtech. The reason is that, in my view, Agtech is limiting. There are many low-tech innovations that have derived exceptional value, for example herring-bone cowsheds, electric fences and fencing pliers. Innovation is a broader and more fluid concept covering innovations on-farm, in the supply chain, by the retailer, and consumers. However, I should also be clear that I believe technology is an important enabler and what people are calling the Fourth Industrial Revolution¹² will have an outsize impact on all sectors and therefore you will see a number of references in this Report to technology innovation, and that in my view is representative.

This Report is also not a comparison of the latest and greatest Agtech gadgets. There are references to cool things I've seen, but for me to weigh-up what is the best Agtech around the world to take us into the

¹¹ The OECD defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. OECD, 2005, "The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual, Third Edition" prepared by the Working Party of National Experts on Scientific and Technology Indicators, OECD, Paris, para. 146.

¹² See discussion of the Fourth Industrial Revolution in Section 5 below



future is in my opinion a fruitless exercise for two reasons. One, you couldn't possibly pick-up on every development and such is the pace of development that six months on this Report would be out of date. Two, this Report does not set out to predict what technology might dominate in the future. I will leave the future predictions to the futurists, pundits and people selling snake-oil.

Fork to farm

Food and Agriculture are often seen as separate industries, but they are obviously interconnected and I believe need to be viewed much more holistically; societies are demanding it and to answer the challenges of the future we should be looking right through from the farmer and grower to the consumer, or as they say *Farm to Fork*. I would argue it should be fork to farm. That is to say we need to start with the consumer and work back to the farmer and grower. Zespri kiwifruit is one of New Zealand's real success stories and is all about a determination at the outset to build the new kiwifruit business from the consumer back to the grower.

Innovation jargon

There is a bit of innovation jargon that you need to get your head around. With any new thing there is a language, or terminology barrier to overcome. The terms IoT, AI or collaborative networks meant next to nothing to me, except perhaps some vague idea derived from Hollywood movies. We need to bridge this gap and importantly develop a common understanding of what innovation means. To help myself and my reader, I have put a glossary in the back of the Report, so if anything sounds new or weird please look-up my layman's glossary of innovation.

3. Global perspectives on innovation

Before we get to the New Zealand context I would like to share what my insights from an international perspective. I had the opportunity to meet and discuss with high-level people and innovative thinkers from Brazil, Chile, Ecuador, United States, Canada, The Netherlands, Italy, Singapore, United Kingdom, Ireland, Belgium and Israel. While the culture and context was quite different in each place, and this influenced how innovation was done, there were important insights to be gained in each country. Due to time and space I have focussed on a small handful of country examples of innovation in this section.

Case study 1: Salinas Valley – Farmers collaborating with technologists

I visited Salinas Valley California, which is known as America's salad bowl; it produces 80% of the lettuces consumed in the US, and a large array of salad vegetables, berries and grapes for domestic and export markets around the world. The farmers and growers in Salinas Valley face major issues relating to water, farm labour and productivity. I met Barry Bedwell, President of California Agricultural Leadership Foundation, who described the situation as approaching crisis-mode.

California has a heavy reliance on labour sourced from Mexico; this is under threat, due to President Trump's promise that he will construct a border wall with Mexico and crack-down on illegal immigrants. There is also political and employee pressure to increase wages and a generation of Mexican-Americans who were raised, educated in the United States and who are now doctors and lawyers and do not want to be out in the field picking lettuces.



Figure 4: The rich dark soils of Salinas Valley clouded in the mist of sprinkler irrigators



Figure 5: Western Growers Innovation & Technology Centre, Salinas

In response to these pressures, farmers and growers in the Salinas Valley have sought help from the huge resource an hour's drive north in Silicon Valley. I visited Dennis Donahue, who Heads the Western Growers



Innovation and Technology Centre in Salinas.¹³ They are bringing technology and agriculture together to help solve these issues. The looming worker crisis is driving automation. They are automating robotic packers, food safety sensing, and harvesting. It has attracted New Zealand companies Biolumic and TracMap who both have a desk at Western Growers. Founder, Bruce Taylor from Taylor Farms said:

“If you are not innovating, you are going out of business.”¹⁴

Case Study 2: Dutch user-led innovation

The Netherlands is the second largest agriculture exporter in the world, after the United States, with \$94 billion in agriculture exports. All this from a country less than half the size of New Zealand’s North Island which 17 million people call home. I met Dutch farmers from across dairy, chicken, pig and cropping sectors. Given the land area and size of population it is not surprising that Dutch agriculture tends towards intensive farming. This creates some challenges for the Dutch agriculture sector.

Speaking to Dutch farmers it was clear that they are under significant pressure from Non-Governmental Organisations (NGOs) and Government, particularly regarding phosphate levels and bio-diversity, as well as from animal rights groups. In the dairy industry processors pay a grazing premium to farmers who have their cows out on grass, which is a result of a covenant made between farmers and NGO’s. There are star-ratings of animal welfare on packaging in supermarkets and during my visit I had an interesting meeting with a representative of an animal rights political party which holds five seats in the Dutch Parliament.

I visited Wageningen University, Livestock Research, which has designed an innovative process to help address the issues of livestock farming in the Netherlands. RIO, translated from Dutch means Reflexive Interactive Design. It’s not a catchy name but I found it very interesting nonetheless. The idea behind this innovation approach is that sustainable development cannot be attained by technical innovation alone, but must work at a socio-technical level, so that producers, consumers and society take-up and support the changes. It is about engaging a broad coalition of actors including Farmers, equipment suppliers, feed companies, extension consultants, NGOs, consumer groups, policy makers and industry representatives.

The system is based on open innovation principles; however, the pragmatic Dutch view is if it is anyone’s system, then it is nobody’s system. So, the RIO process starts with the farmer. Public notices request farmers with crazy ideas to apply. Farmers’ applications are vetted, and they must be willing to be challenged in their thinking. It is about challenging and changing mind-sets of the farmer and the coalition group to generate a solution that is good for: the farmer, the citizen, the animal and the environment.

An example of how they sought to get farmers to think differently, was to take farmers to a zoo for a day to see how zookeepers looked after their animals and how the public interacted with them. Just like livestock farms, the zoo obtains its income through animals. The zoo is also confronted with environmental issues (manure), animal welfare and animal health, and aims to achieve a symbiosis with its environment.

¹³ See <http://www.wginnovation.com>

¹⁴ Bruce Taylor, Taylor Farms. Large US fresh food producer and founder of Western Growers Innovation & Technology Centre.

Three different value orientations give this innovation process direction:

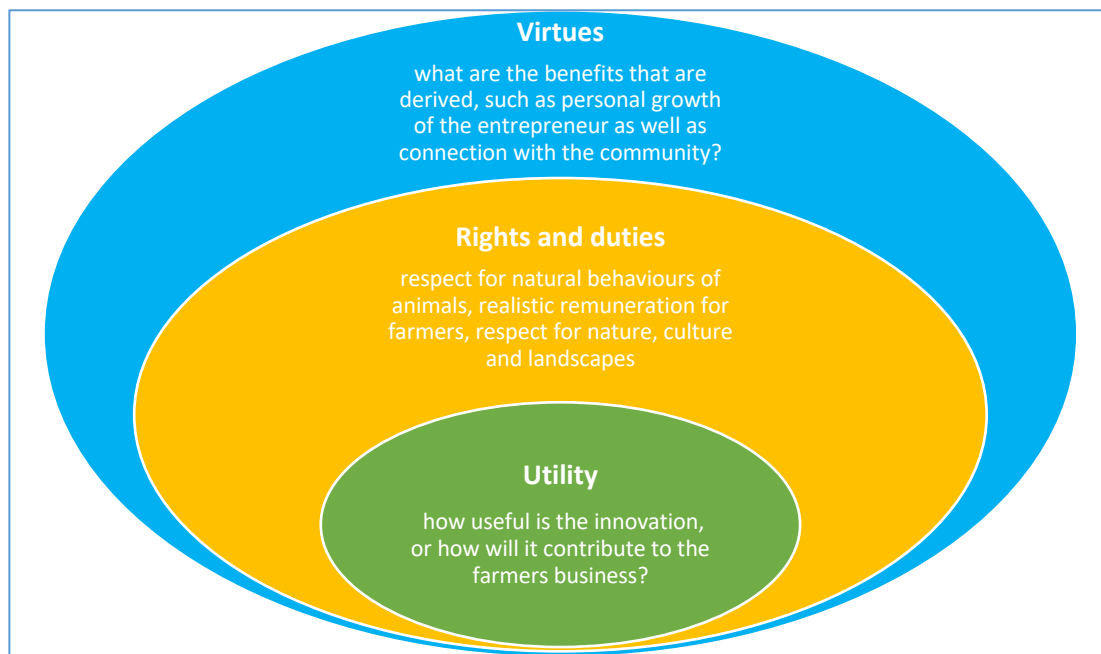


Figure 6: Value Orientation, RIO Model¹⁵

A fundamental element of the process is connecting producers with consumers and understanding what the consumer wants. Farmers visited supermarkets so that they could observe how consumers selected their grocery items. The crucial test was whether the consumer would pay for the new innovation? They have found that the model is a good way for developing, what may seem to be niche ideas, but can be scaled for industry-wide use.

¹⁵ Wageningen UR Livestock Research Paper on RIO, AP (Bram) Bos, Jon Grin



Figure 7: Milking Dutch cows at Nuffield Scholar, Jaco de Groot's Farm in the Peatland of Utrecht



Figure 8: Visiting Nuffield Scholar Willem Van Der Schans farm in Bommelerwaard, in the centre of the Netherlands

Case Study 3: EU Innovation networks at scale

I visited both the European Commission and European Parliament in Brussels. I met Christopher North from the Open Innovation Unit, in the Directorate General for Research and Innovation. The European's are thinking quite differently about how they improve their innovative performance. The European Council had endorsed an 'Innovation Principle', which must be taken into account when developing new, or amending, EU legislation or policy. This would be applied in the same way as the 'precautionary principle' which has been called upon to withdraw products which could be dangerous to health or the environment when not all facts were known.¹⁶ While not in conflict, we can see there is a political signal and perhaps a rebalancing of risk and innovative reward in the EU.

The EU has enormous resources to promote innovation; large research and innovation funds that are meant to support innovation and attract entrepreneurship. Yet, not a lot of innovators and entrepreneurs were taking them up. Why? Because they had to fill out a phonebook for the application form. This was a total turn-off for any would-be innovator or entrepreneur. So, they changed it to a two-page application form and set-up a panel of top-flight innovators who shortlist the applications. The shortlisted applicants then pitch their ideas dragons-den style in front of the innovator panel. The point is if you want innovation, don't put bureaucracy in the way.

The European Commission has a large-scale program aimed at generating innovation in the agriculture sector across Europe. I met with Willemine Brinkman, Deputy Team Leader of the EIP-AGRI Service Point, Directorate General for Agriculture and Rural Development. She is promoting and organising the European Innovation Partnership "Agricultural Productivity and Sustainability" (EIP-AGRI) program.

¹⁶ The precautionary principles is enshrined in Article 91 of the *Treaty on the Functioning of the European Union*. The innovation principle is agreed by the European Council



The focus of this program is on a bottom-up approach with cooperation between farmers, advisers, researchers, businesses and other actors to realise innovations. Farmers are placed at the core of the innovation process, so that their knowledge and needs are linked with the wider innovation ecosystem, ensuring that technologies and innovations are adapted to their specific needs. In the EIP program, groups of 20 participants are selected following an application process. These meet in groups called Operational Groups over a 12-18 month time frame. They typically meet 2-3 times physically and then work virtually. The EU plans to have 3,500 of these groups. The groups are required to share the results of their work through the EIP network and information is posted on a dedicated website.¹⁷ It is expected that the knowledge exchange will generate new insights and ideas and will mould existing knowledge into focused solutions.

¹⁷ <https://ec.europa.eu/eip/agriculture/en/my-eip-agri>

4. A new model for NZ innovation

The focus of this Report, which I hope you have gathered by this point, is looking at how we can use innovation tools and processes to answer the challenges we face:

- 1.) An uncertain and complex environment – VUCA world
- 2.) Societal and consumer concerns about agriculture and food systems – Wicked Problems
- 3.) Encouraging farmer and grower engagement in innovation – Our Greatest Challenge

If we keep doing what we are doing we will get similar results. I firmly believe that a new model based on broad and inclusive collaborative networks is required. It must provide a platform to attract farmers and growers to get involved and to *lead from the middle* in shaping innovation priorities and participate in innovation projects. It must use open innovation architecture to encourage the exchange of ideas and participation of groups across society, including consumers and NGOs. It must be agile and work with speed and generate real action. It must have the capacity to work locally and network nationally and internationally.

What is a collaborative innovation network?

A collaborative innovation network is a group of people who agree to cooperate to share ideas and generate innovation. It is more than a loose network of connected people.



Figure 9: A Collaborative Innovation Network



There is an agreed set of founding principles and ground-rules, roles and a common platform for collaboration. Members of the collaborative network build trusted relationships and are able to access and use competencies not otherwise available on an individual basis. As a consequence, a collaborative network can pursue larger, more complex and thus higher value opportunities, than an individual. The risks for projects are effectively shared among the participating organisations and because of the trustful relationships that are built, there is a strong incentive for joint problem solving and satisfaction of needs from consumer to the farmer and grower.¹⁸

Principles of collaborative innovation

Based on my observation of innovation, research and meetings, I believe there are a common set of principles which will help establish and maintain Collaborative Innovation Networks. These principles are:

1. Leading from the middle

The common conception of leadership, is that of the inspirational leader out-front leading his or her troops into battle. Instead, leading from the middle is about collaborating with people and groups to achieve a common purpose.¹⁹ It recognises in an uncertain and complex world that it takes more than a single visionary leader to be successful, and in fact the single visionary leader is actually a big risk strategy. Groups of farmers and growers should lead and drive innovation from the middle and are well placed to do this for three reasons:

- Problems should be solved by those closest to them. The problems are ours to solve, so we should not farm-them-out to others and hope they'll come up with something.
- The connection with consumers and society requires our engagement; we face a real risk of losing our connection with society. Furthermore there is a strong trend of consumers wanting to know what goes into their food, and increasingly they want to know the farmer and grower.
- Effective, diverse collaborative networks bring ideas together. Working alone within industries is not the answer. Farmers and Growers can be a focal point for other motivated parties to unite around.

2. Bureaucracy is the killer of ideas and innovation

Innovation by nature can be messy. It requires process, but it is often not a linear process. If we try and force too many rules or structures upon innovation, we will squash it, or turn-off the innovators we want to attract. It is also about resources. Innovation clusters, centres or hubs can cost a lot of money. You might have a consultant develop an expensive report as to how it should all work. You then have a Board

¹⁸ Future Cities, Malcolm Fraser, 2017

¹⁹ I was introduced to the idea of *leading from the middle* by Rod Carr, Vice Chancellor University of Canterbury, while attending a meeting with the Rural Leadership Trust Board, which manages the Nuffield New Zealand and Kellogg rural leadership programs.



and a CEO, or Executive Director who is on a decent wage to attract a quality candidate, then a new brand and a website. Before you have really left the starting blocks, a year (or two) has passed, and you have spent a lot of money.

I don't believe this is the way for New Zealand Innovation. We have limited resources and people. We need to be structure-lite, but with emphasis on building collaborative networks and instead invest our money and time in actual projects. Things that will actually make a difference. We need to be vigilant of our innovation networks so that bureaucracy is seen for what it is and is rejected. Having farmers and growers involved is a dependable anti-dote. They generally have a nose for that mouldy odour of bureaucracy, and will call it out, or more likely leave the room because there is something better to do back on the farm, or in the orchard.

3. *Respect for ideas and check your ego*

The collaborative network is the basis for sharing and bringing together ideas. These networks work best when participants operate in a trustful environment and feel confident to express their ideas, no matter how crazy. It is important that these idea networks do not become dominated by researchers, boffins, or any other person who seeks to claim the role as source of all knowledge. The focus must be on the idea and not the person. This requires that all parties check their ego at the door.

Farmers and growers will need to separate themselves from their idea. We must create the forum that constructively allows farmers and growers to bounce ideas off each other. Furthermore, we need to keep in our minds that sustainable change cannot be attained by technical innovation alone; it requires socio-technical change. That is to say we need people to change to get change at a system level.

4. *Dealing with Risk and Failure*

Risk and failure are important concepts in innovation. There are a number of important ideas that have crossed over into broad application from the tech industry.²⁰ The first is the concept of *launch and iterate*. This means you get going with a project, open it up to partners, consumers and then improve it in successive iterations. There is continual testing and improvement. This avoids the problem of spending a lot of time and resources building something that many months away is not valued, or the customer is not willing to pay for.

The second important idea is to *fail fast* or learn-quickly from mistakes. This works well when commitment in money or time is sought from people for short periods of time – it could be as little as 90 days. If at the end of 90 days no progress is being made, or there is no support for further work the project finishes. This helps safeguard spending more money and time on a fruitless project or business. It also de-risks investment in time and money for people to become involved in the project. They are not signing up to an open-ended timeline of commitment, or an open cheque book of spending. Partners can shake hands at the end of the project, then start the next one. Peter Drucker, who is probably the greatest thinker on



management said this on risk:

“People who don’t take risks generally make about two big mistakes a year.
People who do take risks generally make about two big mistakes a year.”

Attitude to failure is important and it’s not just about gung-ho Silicon Valley types, Winston Churchill also considered it worth making the point:

“Success consists of going from failure to failure without loss of enthusiasm.”

5. Nurture the ecosystem and encourage participation

The innovation eco-system is made up of researchers, farmers and growers, advisors, agronomists, start-ups, corporates, finance, incubators, accelerators, government and NGOs. They must contribute and prosper together for innovation to flourish. Going alone results in failure, the potential for disruption, or the inability to scale and make an impact.

I travelled to Mountain View, in the heart of Silicon Valley to visit *Plug and Play* the world’s largest *accelerator*, which has helped turn-out large technology companies such as Dropbox and PayPal. They talk a lot of jargon: bootstrapping, seed funding, Series A, VCs and Unicorns. Listening to people in Silicon Valley talk, there is a common language and common understanding about the power of the ecosystem to create value for participants.

At *Plug and Play* companies were actively engaging with start-up innovation. They recognised that a lot of innovation is coming from start-ups and therefore they have a strong interest in staying close to these developments and supporting them. Firstly, they want to understand the potential for their own business model, or industry to be disrupted. And secondly, they want to build relationships with successful start-ups that can be acquired, or their talent recruited across to their business. Start-ups are also looking for that connection to grow and achieve scale with the help of greater financial muscle of the corporate.

6. Work locally, network nationally and internationally

Innovation must be networked. Israeli innovation occurs in well-organised network clusters, which are strong drivers of innovation. Regions must also be networked nationally. We must partner with other hotspots of innovation around the world. The challenges we face are universal, and they require genuine collaboration and effective networks.

7. Explore the edges

Innovation often takes place at the intersection of different sectors and up and down the supply chain. It might be between health care, waste, transport, regional development, or city development. We need to draw in talent from other sectors to consider where the innovation lies on the boundary between sectors.



Figure 10: TedTalk New York, September 2017.²¹

8. *Speed of development and scale*

Good innovation puts products and services in the hands of customers early. Being able to innovate quickly and cheaply, test products and services in the market, refine them, and release them on a regular basis is key to success. We do not have large user, or consumer markets. Therefore we need to be focussed on the innovations that will meet our needs but that can also be used, or developed further for international customers.

²¹ I attended a TED talk in New York. It was a great experience and showed me the value in bringing people from different stand-points together to share ideas. TEDs catchphrase is "Ideas worth sharing"

Myths, barriers, wrong-turns

On my way back to New Zealand from the United States I watched Spielberg's film *Lincoln*. Flying over the Pacific Ocean, Abraham Lincoln (played very well by Daniel Day-Lewis) made this statement that struck a chord with me:

"A compass will point you true north, but it's got no advice about the swamps and deserts and chasms that you'll encounter along the way. If in pursuit of your destination you plunge ahead, heedless of obstacles, and achieve nothing more than to sink in a swamp, what's the use of knowing true north?"

To help explain what great innovation looks like, it's important to explain what it looks like when it goes wrong. We should understand the myths that are holding things back, the barriers and the wrong-turns which can flatten innovation. By doing so, we can avoid Lincoln's swamps and deserts.



Figure 11: Large statue of Abraham Lincoln, Chicago, June 2017

Agriculture is different

A statement sometimes inferred, or other times directly made, is that farmers are slow to take up new innovations. We are a bunch of conservative, tight-fisted, independent people who will not spend a dollar until the neighbour has tried it and showed it works. With any myth, there is always a grain of truth. However, if an innovation delivers value, farmer take-up can be rapid, especially if the farmer sees the new innovation as a tool – like his tractor, or her water pump.²²

I visited a farmer in Missouri, in the United States. In the blazing Midwest heat of June, we leaned against the back of his truck and he asked me what my Nuffield research topic was. I explained what I was researching, to which he replied with a harrumph, "we don't do any of that fancy stuff here. We just focus on low-cost and no technology." The conversation abruptly finished. We continued on to tour his farm. We walked past cows with *Flashmate* electronic heat detector pads on their backs and surveyed centre pivots with sensors in the ground recording soil moisture levels. Reflecting on our earlier conversation I could see that these devices were simply tools to this farmer. They were not flash-harry innovations, but important tools, just like a tractor or water pump. When you can show the value to the farmer of a new tool, acceptance and adoption can be fast.

²² Take the example of the shift from horse to tractor-power in New Zealand. Horse numbers on farm peaked at 400,000 in 1911 but with the introduction of tractors there was a dramatic decline. In 1919 there were 136 tractors in NZ, but in only twelve years, by 1931 the number of tractors had swelled to over 5,000. <https://teara.govt.nz/en/farm-mechanisation>



Agriculture as a sector is one of the least digitised of all industries.²³ One explanation for this is that agriculture is not in a controlled environment like a factory. It is a biological system involving large variables such as weather, animals and plants. It is true that it is more difficult to measure things out in the paddock (in addition basic digital infrastructure in the regions of New Zealand is very poor compared to urban business sites), the complexity of biological systems, and cost-benefit of other opportunities has delayed development of serious and cost-efficient systems. It may also be the case that while farmers are comfortable with a physical tool, they are not comfortable messing around with software.

In my view, this makes agriculture ripe for a more complex system of decision-making support, involving new technologies such as IoT and AI. I think that in 10 years' time we will look back and be surprised at how much we were leaving on the table, with our current reliance on eye-meters and gut-feel decision-making. We will need to do the work to digitise our businesses to feed these systems the data they need to operate.

These developments might be in the form of feed, mating, environmental monitoring, or managing production more accurately, but equally it may help how we train people and set tasks. Imagine a new recruit completing a virtual reality training program developed for your farm; driving your virtual tractors, sowing your virtual crops, managing your virtual season, before she even sets foot on the farm. Many of the new technologies coming in are becoming so intuitive and user-friendly, even a non-tech-head farmer like myself feels comfortable 'messaging about' with technology. As you flip through your banking, weather, soil moisture and production apps on your smart phone, think about how much technological innovation is sitting behind your swipes.

Age is not the issue either, but rather how entrenched you are in your views. Ray Kroc founded McDonalds at 52 years of age. Prior to that he had been a travelling milkshake maker salesman. The film the 'Founder' starring Michael Keating is excellent and well worth a watch if you want some inspiration, at any age!

A useful check on our thinking around innovation comes from Richard Ashworth, Member of the European Parliament and former dairy farmer who I met in Brussels. He said:

"Tradition is nothing more than innovation done previously."

System resistance and the farm bubble

Innovation by definition seeks to change the status quo. In any system, there are ties that bind to that system. The system will push back against change. This could be from farmers fearing change, incumbent firms quite happy with the status quo; advisers, banks and other support industries who are invested in that system. Sometimes resistance will be overt, sometimes it can be covert; they may say we fully support your idea, but actually we'll slow it down or prioritise resources elsewhere. Abe Kareem argues that

²³ OECD Science, Technology and Industry Scoreboard 2017, THE DIGITAL TRANSFORMATION



“Incumbents have a problem creating anything that would compete with what they’re already doing,” he says. “You need inventors who are dreaming and tinkering to make new things happen.”

We are very good at networking with our peers – at the local pub, at Federated Farmers meetings, at HortNZ, Beef&Lamb or DairyNZ field days. These are all good places to be, but to confine ourselves to them we risk being unprepared for an unpredictable future. There is a cautionary story about predicting the impact of mobile phones in the early 1980s.²⁴ AT&T the American telecommunications company instructed management consultancy McKinsey to predict the size of the mobile telephone market in the year 2000. It came back with advice that it expects it would be 900,000. In 2017, it was estimated the mobile phone market had reached 4.7 billion. Of course, everybody loves to hear a story of where the great have fallen, and I am sure there are many occasions where McKinsey got it right. But the key point is that people inside an industry and even industry experts are not generally good at seeing things coming from outside the industry.

Technology terminology bridge

Are farmers better able to adopt practical innovations (electric fencing, rotary cowsheds) than they are to embrace information technology which might not come more naturally? There is certainly a language, or terminology bridge between the technologist and the user. The terms IoT or AI, might be familiar to farmers and growers but they are for most meaningless acronyms. However, similar to my own experience with the hackathon, this is a journey we are on. I also believe we are aided on that journey by ever-better performance and design, so that without being a tech-head you can still feel very satisfied with your ability to scroll between apps, turn irrigators off and on, check water and production results. It also reinforces a central argument that bringing farmers and growers directly into the development cycles of technology we can influence design, so it is truly user-focused.

²⁴ Economist article on AT&T and McKinsey <http://www.economist.com/node/246152>

Horizons of innovation

McKinsey developed a simple idea about three horizons of growth.²⁵ This can be applied to innovation.

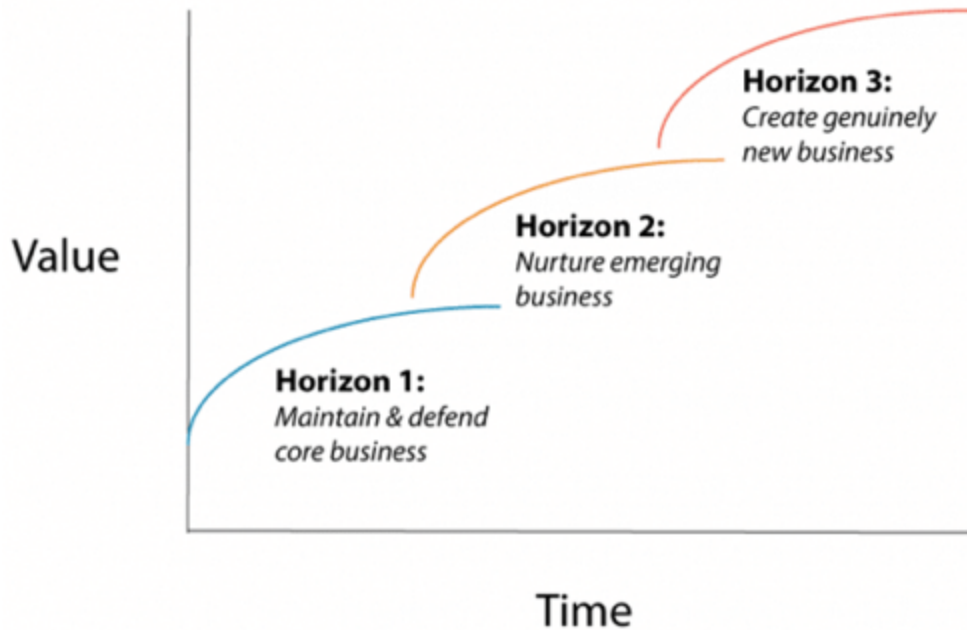


Figure 12: McKinsey Horizons

Horizon 1

This is about continuous improvement. Finding ways to innovate in your existing business, by reducing costs, improving productivity to stay competitive. These are incremental improvements.

Horizon 2

This is a bridging time. Taking what you are currently very good at and extending this as much as possible, through growing the size of your business, reaching new markets. It is also the testing and proving ground for Horizon 3.

Horizon 3

This is about transformational or disruptive change to your business. It creates entirely new businesses. It requires businesses to look ahead and envision the future.

Finance

Securing funding for innovation can be a major problem. Banks are willing to provide finance for existing systems, but are not generally there to support unproven ideas. It is difficult and time-consuming for innovators to bridge the gap between developing a new idea and demonstrating a proven product or

²⁵ The Alchemy of Growth, David White, Mehrdad Baghai, and Stephen Coley, 1999



service; this gap is termed the valley of death' for good reason. In places like Salinas Valley it is access to capital that helps start-ups to innovate and then scale. It is also a question of time, founders can find themselves spending significant time focusing on Seed, Series A, B rounds finding rounds.

5. Global trends - challenges and opportunities for food and agriculture

What are the areas we should be focussing on? Where should we be pointing our newly created innovation guns? There are some mission-critical issues that must be addressed. Understating how these trends will affect us will inform both how we react to them, and what we are developing on-farm now.

Society support – a global perspective

Farmers and growers from California to Wisconsin, from the Netherlands to Brazil, place society concerns about environment and sustainability as one of their top challenges. While it is no consolation, it does give some perspective to know that we are not alone in feeling the glare of the public spotlight. This is one of the biggest issues facing agriculture and food today. This is really an existential issue.

We can continue to improve productivity, seek out new markets, but if the society we operate in concludes that they don't like what we are doing, competitiveness, prices and overseas markets matter little; we will not have a product to put on the shelves. And there are very well-funded, and extremely well hyped alternatives being developed, which market themselves as better for the environment, healthier, safer and better for animals.



Figure 13: Glyphosate Hearing, European Parliament, September 2017

An issue that unites the developed and developing world is producing enough food, with less land, in an environmentally sustainable manner. There is an indisputable fact that in the drive for production to feed people a greater load has been placed on the earth's environment and use of its natural resources. The words of an Italian farmer I met called Ottavio Rube are important to note. He said "We all have to have



a smaller impact on mother earth. Farmers have to be part of it. But we need to choose our lens carefully.” Too narrower lens risks losing context of the big issues we face. Linked to how we do this is the trend around greater transparency.

Transparency

There is an increasing demand for transparency and traceability of food. People want to know how their food is produced and processed and want to be reassured that their food is safe. This is driving a lot of innovation outside the farm gate. But also increasing interest in what is happening inside the farm gate.

This elicits different response from farmers around the world. Some farmers I spoke to resent the intrusion into what they did on farm. They were also wary of activists, acting illegally, taking footage, or damaging or destroying crops or machinery. The obvious reaction is to lock the gates and set-up security. In the case of criminal activity of course it is right for police and the courts to uphold the law. However, on my travels I also saw another approach; a determined effort to open the gates and welcome people in to show them how they farm.

I visited Fair Oaks dairy farm in Indiana with a group of Irish, UK and one American farmer.²⁶ This is a huge operation of 37,000 cows. They serve the fluid milk market, run a butter and powder plant and have a joint venture with Coca-Cola called ‘Fairlife’. They have bio digesters and run their own fleet of tankers on the natural gas produced. It is a truly impressive place.

They had done a lot of work to understand the anti-farming lobby and decided the best way was to be transparent and open up their farms to educate people about farming. They have farm bus tours, restaurants and an education centre. One feature is a seated mini-theatre where you can watch cows calving from behind glass screens. With that size herd, they have 80-100 calves born every day. It is well located next to the Interstate-65 highway that runs through the US and has become known as the Disneyland of dairy welcoming 5-600,000 visitor a year. It is a not-for-profit venture funded 50% by the milk-levy and 50% by gate takings and sponsors. CEO Gary Corbett told us:

“It is a cost to us, but a cost we can’t afford not to pay.”

In the Netherlands, I visited the farm of Dutch Nuffield scholar, Jaco de Groot, who is an organic dairy farmer. His farm is open to the public 365 days a year. Dutch people like to go wandering across fields on the weekends and so the Government provides a subsidy to Jaco to open his gates and let them wander. Jaco told me a story about a visit from a group of school children. He was in the middle of calving a cow that was having difficulties calving herself. Finally, when the calf had been born it was not breathing. Jaco had his back to the children and was doing all he could to revive the calf. The kids peered around each side of him to try and get a better look at what was going on. He turned around and explained to the group what he was doing: how he was removing fluid from its mouth, rubbing the calf to get circulation

²⁶ I travelled with the Positive Farmers Group, led by Michael Murphy to Fair Oaks (<http://fofarms.com>) and down through mid-West to Missouri.



and propping it up to get air into its lungs. The kids were captivated watching him work. The calf spluttered and came to life. That was a nice end to the story. He said that was a real turning point for him; that he needed to be open and show people what he was doing. He said he had another case where the calf had not made it, and he had done the same thing and explained that sometimes, in nature, as well as in farming calves have difficult births and don't survive the experience. He found that people who saw the care he took, and how he explained it accepted it.

I visited other farms that had opened themselves to the public, usually as part of an accompanying tourist business; selling ice cream, or café etc, and they had similar stories. At times, they would get a fanatic come to visit and aggressively question employees or the owner about their farm. They found with some training and careful explanation they could answer their questions and quietly respond to concerns that they had. Did they change their attitudes? Probably not. But it signalled they had nothing to hide. This takes away an emotive and powerful angle; cue the dramatic music, faux investigative documentary style and voice over exposing an apparently dirty secret, i.e. that we have something to hide behind the farm gate.

Openness and transparency does have an effect at a personal level with people. 'Maintaining the rage' is an important part of activism. By being open and transparent you demonstrate that you are not a double-headed monster, that you have processes and that you believe in what you are doing. Again, it may not change views, often these views are entrenched and groups have been funded to pursue a campaign purpose. What it can do is help elevate the level of debate, and make it more difficult for activist groups to pursue a patently false argument. It can help provide a more informed debate. As Dwight Eisenhower said:

“Farming looks might easy when your plow is a pencil
and you're a thousand miles from the corn field.”

Consumer focus

We often hear that farmers should tell their story better. Some take that to mean we should all be getting out and speaking about the way we farm. I think it is more nuanced than that. We should actually be listening first to understand what it is that will make an impact to our audience; this is opposed to banging on about what we think is important and what we think people want to hear. I visited Maker's Mark Bourbon Distillery in Kentucky. (Yes, that's food and agriculture too!). Written on the wall was the following quotation about Bill Samuels, the founder of the distillery:

“My Dad once told me that anything you could say about good whisky
had already been said about bad whisky...
you can't bore people into buying your product.”

I believe we are in a better position than almost any other country in the world in terms of the way we produce food. Yet as the quote states we cannot take that for granted and many of the things we believe we have strong foundation in are already claimed by others. We need to address some issues, but we should also not be shy in showing our customers the great way we produce food. We need to develop 'Prosumers': consumers who are proud to buy our products.

We need to be aware that there is growing power for consumers. This is being driven by direct connection between consumer and services, or product provider. Take the example of Airbnb or Uber. The consumer give direct and immediate feedback on the place they stayed at, or the ride they took. Other uses of those services check reviews and feedback before booking their trip or stay. When will we have direct feedback from consumers on the steak we produced or the cheese we made?

Buy local is a big trend in the United States. I spoke to a New Yorker at an Agtech conference in California who said Buy Local was the most important for her. We discussed what it means. Does it mean that consumers want to support their local farmers? Does it mean that consumers are concerned about the carbon footprint of their food? Or does it mean that they prefer local because they feel they know how food is produced locally, under US regulations, in a safe way. While it may be parts of one and two, actually the third answer is most correct. People in the US prefer to buy local because they trust the source of their food. Organic food sourced from Mexico is less demanded than organic food from the US. I believe NZ can position itself as the Buy Local for the world, addressing the consumer values of health, animal welfare and environment.

Fourth Industrial Revolution

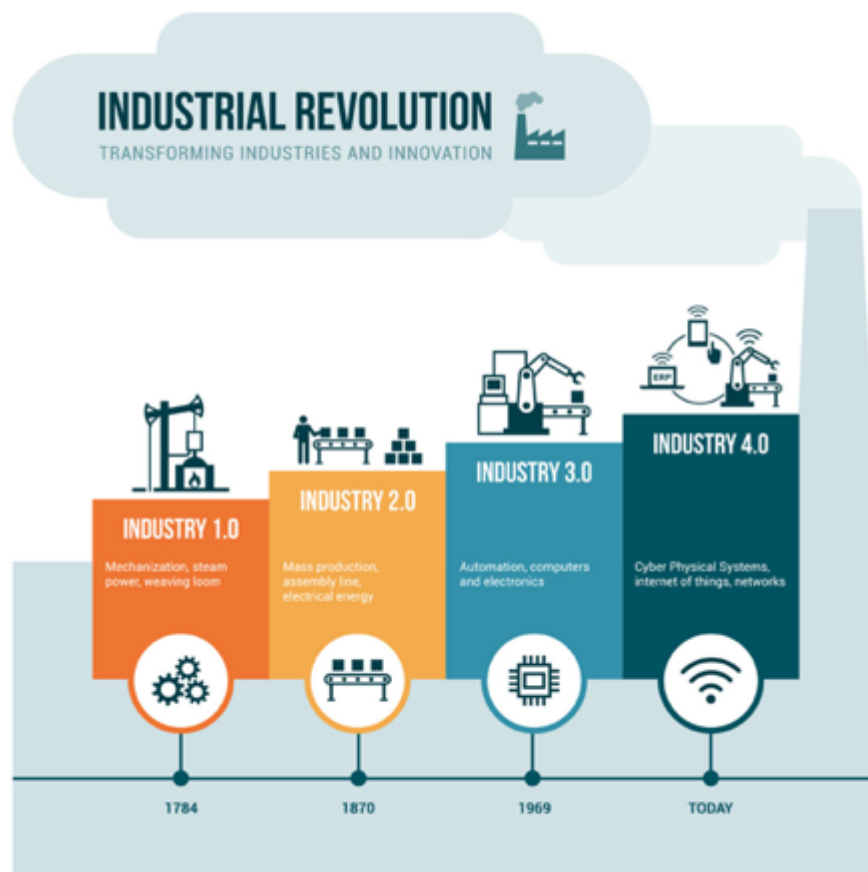


Figure 14: Industrial Revolutions, Spacenews.com

The World Economic Forum explains: “The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.”²⁷

We are only at the start of the Fourth Industrial Revolution but there is already an astonishing range of technologies being developed on the farm, in the supply chain and by the retailer, including cloud computing, artificial intelligence, Internet of Things, block chain, 3D printing, Big Data, biotechnology, intelligent robotics & equipment, and novel farming systems.



Figure 15: Visiting Amazon HQ, Seattle, June 2017



Figure 16: Visiting Microsoft HQ, Redmond, June 2017

The largest four companies in the world by market capitalisation are all technology companies – Apple, Alphabet (Google), Microsoft and Amazon, and these tech titans are beginning to turn their attention to food and agriculture. I travelled to the West Coast of the US to see what it was all about.

I attended an Agtech conference *FoodIT ‘Fork to farm’* organised by the Mixing Bowl, in Silicon Valley. Start-ups were pitching their ideas to a judging panel. One start-up founder who was building a robotic restaurant was asked by a judge if he had approached Starbucks to work with them. Without batting an eyelid, he replied:

“We are not thinking about partnering with Starbucks. We are going to be the next Starbucks.”

A little bit of American exuberance perhaps? Yes, and there is acknowledgement that 8 out of 10 of these start-ups fail. But then they re-invent themselves. And you would not bet on some of them succeeding in

²⁷ <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>



a big way. What I saw plainly was a disruptive mind-set. You can almost smell disruptive innovation in the air. People are not thinking about how to improve things, but how to re-invent them, re-engineer supply chains, create something new, or disrupt the status quo. I met with David Roth, Amazon at their headquarters in Seattle just days after they had acquired Wholefoods a large organic supermarket chain in the US. He said Amazon is like the world's largest start-up. They have a disruptive model aimed at taking control of large parts of the supply chain.

Elon Musk is another disruptor, who has brought disruption to the fossil fuel car market through his Tesla electric cars. He has also torn up the rule book in space travel, by creating re-usable rockets through his Company SpaceX. Musk is now turning his attention to the construction, by *The Boring Company*, of a network of 3D underground tunnels where cars will travel on a skate at 200km per hour under cities. In a TED Conference interview, Musk was asked why he would pursue this project when it was so expensive to dig tunnels underground. He acknowledged the current cost of \$1bn/mile for subway extension was prohibitive. He insisted he will achieve at least a ten-fold improvement in the cost of tunnelling. This would be done by reducing the tunnel diameter, and redesigning the tunnelling machine so it can dig and reinforce the tunnel at the same time.²⁸ To illustrate his point he said they have a snail which moves at the same speed as current tunnelling. His aim is for his Boring Company to beat the snail.

In this disruptive future the skills of our workforce are critical. We need to be equipping people with skills and the ability to acquire skills that will be in demand in the future. Our training and development of our people is key to solving the problem of the relevancy of skills and technological change.

²⁸ TED Conference interview Elon Musk: [The Future we're building and boring](#)

Conclusions

I believe New Zealand has a unique advantage that with massive and determined action to create collaborative innovation networks, can position itself as the place to develop, trial and test new innovations in food and agriculture. We have a tremendous amount of entrepreneurial and innovative capacity within our country. We have the ability and tools to develop a compelling story that resonates with consumers about how we produce our food. That does not mean we need to throw our current systems out, but the innovations we develop today will set ourselves up to be successful tomorrow.

I have taken you on a journey of discovery of innovation. I have given you examples of innovation from around the world. I have also set-down the principles that will help design successful innovation networks and described some of the myths, barriers or wrong turns which are holding us back. I hope this has provoked new ideas, given you guidance, along with a set of tools to get involved. I have sketched out what we have done and are planning in the Manawatu to initiate farmer led innovation.

Kick Starting the Manawatu Farmers and Growers Innovation and Technology Collaborative

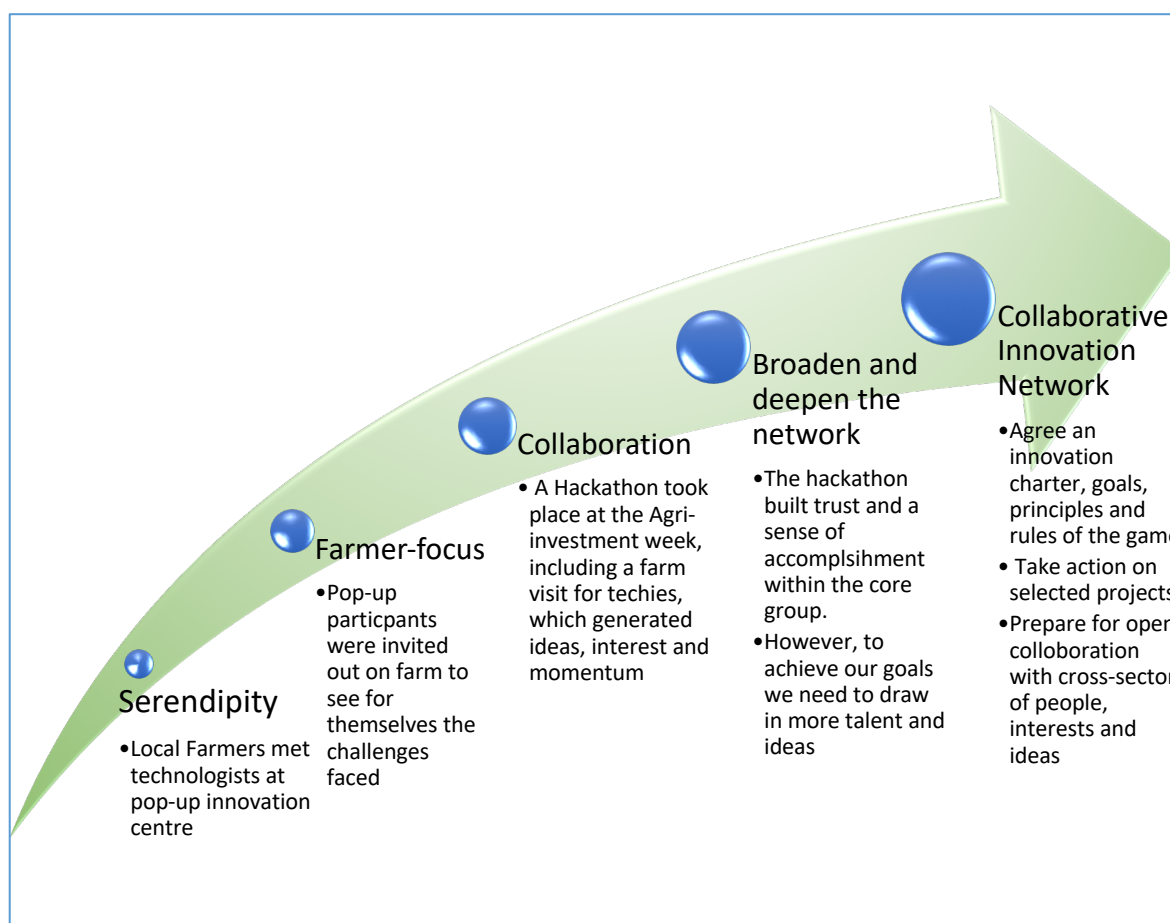


Figure 17: Network formation

I hope to take this concept and process, enhance it, and spread it to farmers across NZ. Wherever you are reading this, you will I'm sure have slightly different context, people and issues, but if you are willing to step-up, follow the principles and advice laid down in this Report I am sure that you will soon be contributing to New Zealand's next big innovation.

My challenge to farmers and growers is to bring your ideas, your passion and practicality. Are you going to continue to let others define your farming future? Or are you going to get into the driver's seat and drive it yourself? Come and join us on this innovation journey to solve our wicked problems.

A connected system of farmer led collaborative innovation networks.

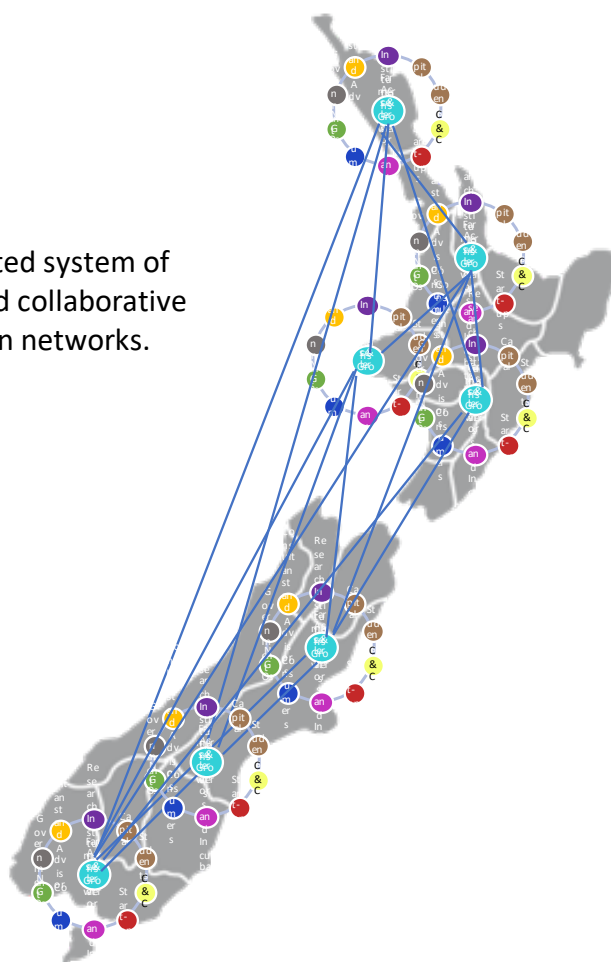


Figure 18: Collaborative Innovation Network of farmers and growers across NZ

Recommendations

A summary of the key recommendations made in this Report:

- 1.) Place farmers and growers at the centre of innovation in the agriculture and food sectors. Design and stand-up collaborative networks that engage with consumers and society for sustainable and value creating innovation. Developing ways to connect with consumers and society that demonstrate transparency, build trust and show value are critical areas.
- 2.) Promote an eco-system approach to innovation. Innovation will flourish when parties each benefit and contribute to the innovation. This might be in the form of solving a problem, developing a product, or service offering, generating data, or showing the way to the next wave of innovation.
- 3.) Remove all barriers that discourage people from engaging in innovation. For example, in the EU they took away the 'phone book' size application for innovation grants and introduced a dragon's den style application, which created more interest and was accessible to innovators and entrepreneurs.
- 4.) Invest at the project-level for innovative ideas and do not over commit resources to management and reporting layers. We have limited resources and we must apply them to actual work. Visions of the way the world should be will not get us there.
- 5.) Promote the adoption of an innovative consciousness. Generate new ideas and collide them with others. This is more than the number 8 wire approach and requires the adoption of a principles-first attitude to what is possible. Real change occurs when there is a social and technological innovation. If we think throwing new technology will solve our problems we are mistaken.
- 6.) Promote open collaboration between regionally based centres of innovation, and international innovation centres in US, Netherlands, Israel, Chile, Ireland, UK, Brussels and Australia. The issues are national and international, as are our consumers as well as pressure groups.
- 7.) Actively engage people from other sectors. There is often innovation on the edges between sectors and the cross-pollination of ideas and methods.
- 8.) Understand the time horizons of innovation and what is required a.) now to remain competitive and stay in business, b.) what is the third horizon opportunities c.) what is the second time horizon innovations required to build skills, expertise and products to grab the opportunities of the third time horizon

About the Author

Mat Hocken is 39 years old and is married to his wife Jana. Together they have two young daughters Annabelle and Gabrielle. Mat farms 1,000 dairy cows with his Dad on their family farm *Grassmere* in the Manawatu. Mat is the fourth generation of Hockens to farm there. His great grandfather bred and sold draught horses. His grandfather farmed sheep and cropping. His Dad converted to dairy in 1975.

Mat grew up on the farm and went to school locally at Colyton School and Palmerston North Boys High School. He studied law and commerce at Canterbury University, NZ and was admitted to the Bar as a barrister and solicitor. Following his undergraduate studies Mat completed a Masters at Cambridge University, UK in politics.

After his Cambridge studies he worked in Brussels for five years in a public affairs and communications consultancy. He met Jana and together they moved to Sydney in 2009, where Mat worked for the Australian Federal Government agency EFIC as a senior adviser for government and industry relations. In 2013 Mat and Jana came home to the family farm, where he is focused on growing the family farming legacy and building an innovative and successful business. Jana has her own business as a lean consultant, and is helping Mat and his team apply lean to their dairy farm.

Mat has played rugby to a high level and represented New Zealand at under 21 level. At Cambridge he earned a Blue playing in the annual 'Varsity Match' against Oxford University at Twickenham. While in Brussels he played rugby for the Brussels Barbarians, represented the Belgium national team and played for the Barbarians.



Figure 19: Mat, Jana and their two daughters Annabelle and Gabrielle in Prague, December 2017



Contact Details

Please do not hesitate to contact with me if you wish to find out more about my Nuffield studies, or anything relating to this Report.

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Glossary

Accelerator	Accelerators provide programs for early stage companies (start-ups) to accelerate growth through short-intense week or month programs, with mentors and introductions to corporates. They may also invest. Related to Accelerators are Incubators. These provide a platform to incubate ideas in the hope of forming a start-up. I visited Plug&Play in Silicon Valley, which is the world's largest accelerator. They count PayPal and Dropbox amongst the companies they helped accelerate. http://plugandplaytechcenter.com
Agtech	Agtech is a broad term that can mean different things to different people. For the purposes of this report I take it as the intersection between agriculture and technology, this can include technologies interfacing with farmers, as well as those outside the farm gate, such as biotech, retail, consumer.
AI	Artificial Intelligence (AI) is a term used to describe machines performing human-like cognitive functions (e.g. learning, understanding, reasoning or interacting). It has the potential to revolutionise production as well as contribute to tackling global challenges related to health, transport and the environment. AI technological breakthroughs such as “machine learning” coupled with emerging technologies such as big data and cloud computing are strengthening the potential impact of AI.
Airbnb	You book a room, an apartment or an entire house that is owned by someone else. It can be a great low-cost and also friendly way to stay when you travel. You get to meet the locals and I would often share a drink of wine with my hosts at night and I'd tell them of my travels.
Fourth Industrial Revolution	The World Economic Forum says this: “The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited. And these possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D



	printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.”
IoT	The Internet of Things (IoT) refers to applications and services that are driven by data collected from devices that act as sensors and interface with the physical world.
NGO	A usually non-profit organization that operates independently of any government, whose purpose is to address humanitarian, educational, healthcare, public policy, social, human rights, environmental, and other issues to effect changes according to their objectives. NGOs are usually funded by donations, but some avoid formal funding altogether and are run primarily by volunteers.
No. 8 wire	The tradition of Kiwi ingenuity is often known as the ‘no. 8 wire’ attitude and it refers to a tradition of Kiwi (New Zealander) invention. It is actually a gauge of fencing wire that has been adapted for countless other uses in New Zealand farms, factories and homes. ²⁹
Open Innovation	A model of innovation opposite to the traditional vertical integration model where internal R&D activities lead to internally developed products that are distributed to the business. Open innovation assumes that useful knowledge is widely distributed and that even the most capable R&D organisation must connect to and leverage knowledge outside the business as a core process in innovation.

²⁹ See No.8 Re-charged for examples of modern day application of the No.8 attitude.