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Rural leadership – taming the wicked problems:

Growing the toolbox to foster society's trust through strategic solutions for all.

By Ben Hancock

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Executive Summary

Societal and regulatory issues facing the agriculture have been escalating, and unrelenting – the demands on production and cost of food, society's perceptions of agriculture, and the regulatory burden. These complex, contrary, large and evolving issues are truly wicked problems.

Agriculture needs to be involved in the issues and to be leading development of the solutions – not reacting – in part, to maintain and build public trust. Agriculture has the expertise but needs to be in the position to be masters of their own destiny. The overarching objective of this study was to position the agriculture industry as leaders in solving wicked problems that face the industry, effectively and efficiently.

This sets the scene that requires an understanding some of the potential drivers of the perceived rift between agriculture and wider society and regulators. Understanding the gap and agriculture's position in the context of wider society creates a starting point and identifies an avenue to explore how to put farmers at the forefront of developing solutions.

The connectivity between rural and urban communities has widened. A shift to more urbanised populations has been occurring for generations and diminished direct relationships between the two communities. The weaker connection reduces the ability of the urban population to contextualise issues facing agriculture, and for the rural communities to relate them to the urban population.

In developing a durable relationship in which both parties have regard for the other's interest – institutionalised trust – there are three elements that provide a foundation. Agriculture has a large influence on two – economic legitimacy and interactional trust. Agriculture has less control on the third – socio-political legitimacy – yet many wicked problems develop from this area. I sought out approaches that agriculture could incorporate to gain more control in building socio-political legitimacy.

The initial approach of seeking to "get ahead" by being first to pick up on any problems was unsuited for the agriculture sector. Four methods were explored; venture capital investment strategy, web analytics and data tools, scenario testing, and expert and stakeholder panels.

Applying these practices to identifying future issues was generally still reactionary and contained a relatively high element of risk. Any returns for success would be difficult to identify and reward from success difficult to gain or quantify – the position of agriculture is not markedly improved relative to other elements of society. There are uses from the practices explored and they are suitable for other objectives, but none clearly suited the objective of getting in front of the issues.

An alternative approach was to understand the values held by other parties affected or involved with agriculture to find alignment that addresses wicked problems, and identifies potential points of conflict. In a series of meetings, I was introduced to the field of bioethics. The three bioethics tools I presented were; the ethical matrix, the ethical Delphi, and reflective equilibrium.

While there are elements of overlap with these three tools, each had variations of objective, process, outcomes and use. At a high level:

- The ethical matrix creates an inventory for the range of views and values held by affected parties in context of the issue through deliberation;
- The ethical Delphi is more appropriate to arrive at a reasoned consensus amongst experts in a field by directed reiterations, and

- Reflective equilibrium, which is another reiterative process, seeks to reach a moral judgement by taking an intuitive and experienced perspective on an issue, testing it against existing knowledge of the field, putting that in the context of relevant moral principles, and then relating it back to intuition and experience – repeating the process until a stable position is achieved.

These were an introduction to the field to highlight the bioethics tools use for agriculture to understand the range of views and perspectives on issues the relate to agriculture. Research, knowledge and experience of experts are incorporated in these processes but, importantly, it is framed in a manner relevant to wider society.

Wicked problems are difficult to define, without clear solutions and often driven by other issues. Bioethics tools provide an approach to understand the potential drivers and arrive at optimal outcomes for all affected parties.

Recognising where there is alignment in values and objectives amongst groups identifies opportunities for the agricultural industry to bring society along in solving issues facing the industry. Detecting divergence in values held by affected parties identifies the potential points of conflict. Understanding the values that are behind the range of views presents an opportunity to effectively communicate and resolve perceived discord.

Detecting issues before other affected parties was identified to not be the best approach to build trust towards agriculture. If success could be gained in identifying an issue, the response is still reactionary and there is still an element of being adversarial towards other parties – not leading.

Encouraging systems-thinking in stakeholders and interest groups affected or involved in the issues facing agriculture is key to developing effective solutions and create opportunity for synergies in policies and practices.

Adoption of bioethics tools aids the agriculture industry to recognise and construct alignment with other segments of society. Nurturing an affiliation with agriculture in wider society becomes more manageable if the values underlying the spectrum of views is understood – making issues and concerns of agriculture relevant to other segments of society.

Building relationships experts in the field of bioethics will be necessary to best use these tools in addressing the wicked problems. It is an immense field of diverse tools and rural leaders would be more effective with the guidance of specialists with an in-depth knowledge of tools and processes.

Scholar biography

Currently, I'm employed by Beef + Lamb New Zealand as the Senior Insights Analyst, getting involved in some of the complex issues facing the sheep and beef sector, agriculture industry and rural communities. Originally, I was raised on my family's hill country sheep and beef farm's in the South Wairarapa – with the main farm in Hinekura and the finishing block on the edge of Martinborough. I had a very fortunate childhood of pig hunting, fly fishing, sport, horses and bull-riding in rodeos.

My upbringing during the 1980s and 1990s strongly influenced my drive to work for the sheep and beef sector. The drop of our district's population due to the economic reforms of 1980s had a significant impact on the area. This was followed by the least profitable decade for sheep and beef farming in New Zealand – the 1990s, which ended with three years of drought. Growing up in this environment, knowing the effort and difficulties that rural communities went through, shaped my motivation to represent my community. But I had a round-about journey before coming back to the sheep and beef sector.

With a strong desire to be working outdoors and with animals but branching away from the farm, I completed Bachelor of Science in conservation and ecology at Lincoln University. After working for the Department of Conservation, translocating threatened species (North island brown kiwi and North Island kokako), I spent a couple of years working abroad on avian research projects. Firstly, in Maui, Hawai'i, then Upper Peninsula, Michigan, and then for the Smithsonian Institute on Barro Colarado Island in the Panama Canal.

I returned to New Zealand to complete my Master of Science in biodiversity and ecology at Victoria University of Wellington. After some more threatened species work, I completed my Doctorate on ecosystem services in the viticulture back at Lincoln University. I came back to the sheep and beef sector I was raised in after a period working in the wine sector and a brief stint at the Ministry for Primary Industries in biosecurity policy.

Before my current role, I was in Beef + Lamb New Zealand's Economic Service, a deep well of knowledge and understanding of New Zealand's sheep and beef sector – a great education across the sector and how it fits into the world.

Fairness and empathy for the agriculture industry is a major driver for me. This comes from taking the time to understand rural communities and what they provide for wider society. Importantly, this understanding is necessary in both directions. While I live and work in Wellington, I'm back on the farm as often as possible, which gives me a great exposure to the range of perspectives and issues facing agriculture.

I feel privileged that my career has arrived at a point that combines my upbringing with my experience, academic career and environmental work to benefit my community.

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Acknowledgements

I would like to express my sincere gratitude to the New Zealand Rural Leadership Trust Trustees and the Rural Leaders team, and my mentor James Parsons. This is an immense opportunity - a life changing opportunity – and I will be forever grateful. When asked about the scholarship during my travels, I often found myself explaining the history and what the Nuffield scholarship entails to almost disbelieving listeners.

None of this would be possible without the support of my family and friends who held down the fort while I was away. Literally, helping get my house in order – we finished re-roofing my house two days before flying, a house that didn't settle until after I had left. More importantly, supporting and providing me with the opportunities to get to this point.

Beef + Lamb New Zealand have been extremely supportive of me doing the Nuffield scholarship and during the journey. I would like to particularly like to acknowledge the support and feedback from the Economics and Insights team.

One of the clear highlights has been meeting the other scholars from New Zealand and around the world. A diverse group of producers and industry people who are thoroughly enthusiastic about what they do, always keen and engaged to have far-reaching conversations and good-natured debates regardless of their own background or perspectives. Thank you for your insights and welcoming into your homes.

This report touches on some of the meetings and people that I met, but there were far more. The doors that the Nuffield scholarship opens are unparalleled. A standout was a free afternoon I had in California and in two hours, through the Nuffield network, I had a meeting with Karen Ross, Secretary for Department of Food and Agriculture – essentially the Agriculture minister for the world's sixth largest economy and US's highest state for agricultural sales.

The hospitality and frankness of the wide range businesses and people, in different continents, that I met with was appreciated. Their generosity and contribution add incredible value to the education I gained on my journey. These experiences will stay with me.

Objectives

In order to better position agriculture as leaders in developing solutions for wicked problems facing the industry, I set three major objectives:

1. Understand some of the potential drivers of the perceived rift from agriculture to wider society and regulators.
    - Develop an understanding of the context of where agriculture is currently placed, and the direction needed to overcome the perceived divergence.
    - Identify the approach, and what the agriculture industry can control, to effectively strengthen agriculture's standing as leaders in creating solutions – rather than only being participants in the solutions.

Armed with the knowledge of where the rift existed between agriculture and the position where rural leaders are best placed to be involved in solving these wicked problems, I sought to identify different approaches to achieve these solutions.

2. Explore various methods of scanning and identifying future risks or issues, and the suitability of these methods to being incorporated into the agriculture industry. In identifying these issues early, agriculture is positioned to be get in front of the wicked problems to lead the conversations, and contribute to the development of effective and efficient solutions.
    - Employing tools to seek out the issues before they develop into wicked problems that erode public trust in agriculture.

3. Investigate processes to facilitate rural leaders in comprehending the origins of the views held by other segments of society.
    - Understanding the range of motivations and values held by other groups that are affected by these wicked problems, rural leaders can identify potential points of conflict and themes where there is alignment.
    - By knowing the perspectives of all affected parties, the agriculture industry is more capable to relate issues to the various affected parties in a meaningful manner to help build consensus and address the wicked problems.

Chapter 1: Introduction

The current waves of external pressures being experienced by agriculture sectors feel like they have hit a crescendo. When I began my Nuffield, primary industries were facing increased regulatory burden and there were high-profile societal pressures. The nature of the issues these pressures create are truly wicked problems. Problems that are difficult to define with no clear limits or boundaries, no right or wrong solutions, often a result of other issues, and the solutions are difficult to test (Stony Brook University, 2020).

There was the One Billion Trees (OBT) policy (Te Uru Rakau, 2020), various regional environmental frameworks, alternative proteins (Beef + Lamb New Zealand, 2018), questioning of the relevance of agriculture to New Zealand, and freshwater was a central feature of the 2017 general election. I felt getting ahead of these issues so we could lead – not react – warranted exploration for my Nuffield scholarship.

Since beginning my scholarship, this has escalated; the Zero Carbon bill (Ministry for the Environment, 2019), the Essential Freshwater policy package (Ministry for the Environment, 2018), national policy statement for indigenous biodiversity (Draft National Policy Statement for Indigenous Biodiversity, 2019), national policy statement for soils is coming, plus OBT and regional environment work. While the shine is coming off alternative proteins, the conversation about different food production systems, their environmental footprint and role in human health is maintaining its high profile.

The context and place in society that agriculture occupies will always be a continual discourse – food and fibre is essential to our being and how we live. However, 2018 and 2019 – and the coming 2020 – have been exceptional years. Rob Davison[1] declared that in his over 45 years in the Beef + Lamb New Zealand Economic Service, that he has never seen social and political climate like this before – with potentially the greatest upheaval since the reforms in the 1980s. And, there's little cause to expect that this will ever go away completely. There will always be another issue.

The average farm profit before tax for sheep and beef farms in the decade starting 2010 was the highest in real terms for six decades (Beef + Lamb New Zealand, 2019). Yet, the mood of the sector is not optimistic and faces great uncertainty (Federated Farmers of New Zealand, 2019; Trafford, 2019; The Detail, RNZ, 2019).

This is not limited to New Zealand. Time and again during my Nuffield travels, the topic of external socio-political pressure on the agriculture's ability to function was frequent. There were many instances of perceived divergence at the intersection between the wider community and agriculture industry – particularly in advanced economies – despite varying production systems, societal norms and regulatory settings.

It is hard to disagree with the intentions of many of the proposed policies. They are virtuous, and aspirational objectives. However, the road to hell is paved with good intentions. Agriculture needs to be in a trusted positioned, enabled to aid in solving some of society's complex dilemmas.

There's an important role for rural leaders to play in getting ahead of the game. In an age of "fake" news, how do we get the truth into the conversation. We can't expect the layperson to have the expertise of agriculture, but often a factual argument seems to fall flat time and again.

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[1] Rob Davison – Executive Director, B+LNZ Economic Service, Officer of the New Zealand Order of Merit (service to sheep & beef industry)

"How easy it is to make people believe a lie, and how hard it is to undo that work again!"– Mark Twain

In an ideal world, the default would be that wider society trusted producers of food and fibre, that they are allies and will benefit consumers, society and the world we live in. My perception was that farmers were seen as needing regulation, and reaction to flawed policy or prescriptive rules could be perceived as railing against well-meaning goals. I wanted to explore how the agriculture industry can get in front of the issues to lead in developing effective and efficient solutions, and maintain and build trust with wider society.

Farmers have an immense degree of expertise and knowledge of natural systems. I could discuss high level concepts of my PhD in ecology with producers more readily than compared to the general public, and they were active in these conversations. Producers should be a powerful trusted tool to be used in addressing large environmental issues facing society, rather than an industry to regulate and constrain.

In developing my Nuffield project, I began to explore what may drive the perceived widening gap and trust between agriculture and wider society – this perception was reinforced during my travels. Some of the ideas that I considered were:

- Changing demographics and decreasing connectivity as drivers of the lack of trust,
- Aspects of agriculture's relationship with wider society that it should be involved in to gain influence, and
- An approach to explore for agriculture to effectively get in front of societal and political issues and lead.

As a potential solution, I sought means to identify potential issues before they rose in public profile. By pre-empting instances where trust could be eroded, and agriculture can be engaged as a leader in the issue and drivers of effective solutions by early involvement – rather than reacting to prescribed regulation. Of the methods I explored, I'll discuss:

- The suitability of venture capital firms' approaches in taking on new projects;
- Data mining and monitoring;
- Scenario testing; and
- Expert and stakeholder panels.

In seeking out methods to identify potential issues early, I was introduced to bioethics during my Nuffield journey. The bioethics tools I investigated through my travels were generally to understand the values and expertise around a technology or issue. The three I highlight in this report are:

- The ethical matrix,
- The ethical Delphi, and
- Reflective equilibrium.

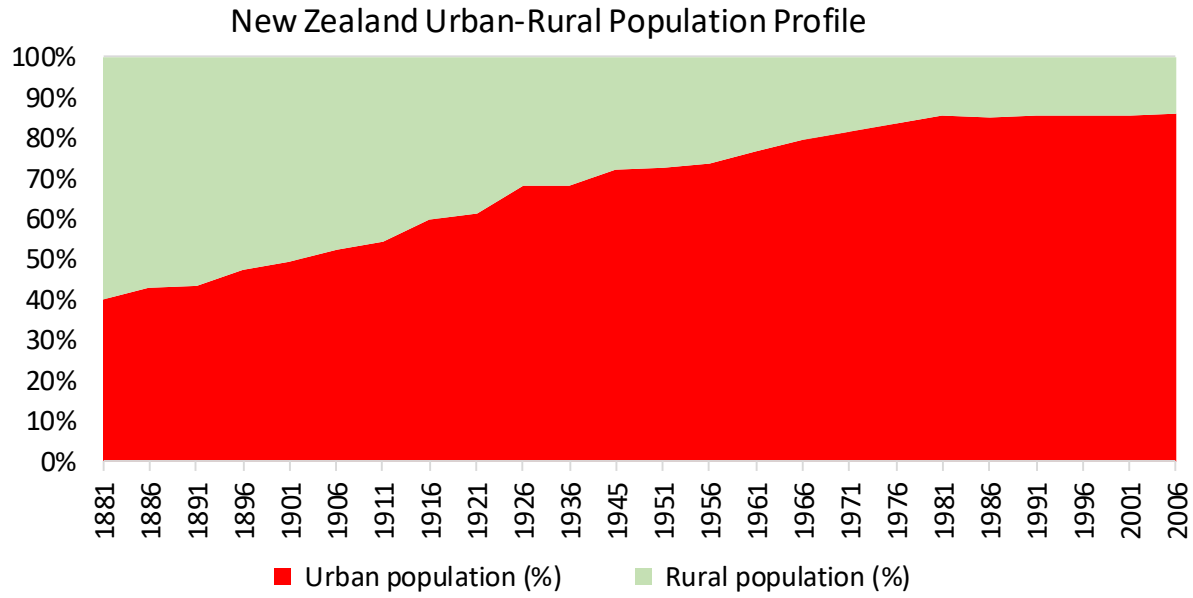
These are designed to reach an equitable conclusion based on the values and expertise involved, though not necessarily making the decision. The process of reaching these equitable conclusions explores the range of values in the context of the existing expertise, which helps to understand the commonalities between stakeholders and points of conflict – and importantly the drivers.

Bridging the gap

A significant contributor to the perceived divergence in values is the decline in connectivity between producers in rural settings and urban dwellers that consume and provide services to the economy. Since the 1970s, New Zealand's urban population has been steady around 85% of the total (See Figure 1). New Zealand is now going past two generations since reaching this plateau. This is by no means limited to New Zealand.

As the urban connection to rural communities diminishes, there is less opportunity for the urban population to have a direct relationship – an aunt, uncle, grandparent or cousin – to humanise and contextualise the commentary they hear. Importantly, the motivations of producers are also lost. Many farmers have non-production/profit drivers in their business; family, stockmanship, playing with equipment, environment.

Figure 1 New Zealand urban-rural popualtion percentage profile



Source: Statistics New Zealand Census Data

I got to see broad-acre farmers from Illinois to Northern Romania, beef producers in Ireland and Iowa, orchardists in California and dairy farms in Kenya. Without fail, the people, family and community featured heavily in how and why their businesses were run.

A clear example is in the introduction of The New Biological Economy (Pawson, 2018). It notes often, New Zealand's agriculture focus on production above all else. Farmers introducing themselves by the production type of their farm could be seen as suggesting that is their focus. Whereas, someone that has that a connection with producers understands the lifestyle entailed with being a South Island high country farmer or running a Bay of Plenty kiwifruit orchard.

Farmers and customers are central to agriculture (Figure 2). The industry, environment and connections built around this enables an efficient connection between farm and the consumer. New Zealand's unique export focus creates more of a disconnect between supply chain and partners, marketing and market access, to society and politics, and environment compared to other societies.

Figure 2 Mosaic of connections of the agriculture

Source: Beef + Lamb New Zealand

However, primary industries are generally held in a positive light. A survey of 1,000 general public in New Zealand found a strong positive view of the different sectors; sheep and beef – 54% positive:12% negative, dairy – 51%:20%, horticulture – 68%:4%, forestry – 56%:9%, and fisheries – 47%:16% (Ministry for Primary Industries, 2019). Yet, the waves of regulation facing the sector have risen.

Some of the big points of conflict between wider society and agriculture abroad have been transplanted to New Zealand – despite not necessarily being relevant. That lack of connection and personal experience with farmers to see first-hand how farming operates in New Zealand contributes to this lack of understanding.

While travelling with Nuffield scholars – kiwi and other nationalities – I saw first-hand some of these practices that have driven some of the high-profile antipathy. They did not always sit comfortably with us. However, this was looking from the outside without understanding the limitations and history that led to their production developing in that way.

Agriculture has adapted to this gap. During my Nuffield travels I saw plenty of innovative ways to present farms and how they were operated to the wider public. A Dutch goat dairy farm with a function centre that has viewing areas and outreach information. In Kentucky, a farmer started out by bringing a bus load of elementary students to his farm. This developed into the children growing their own produce to pay for the bus trip. Bord Bia (the Irish Food Board) had many large public engagement programs; recipe competitions, a partnership with Dublin zoo creating syllabus, a mobile farm, flower festivals and open farms.

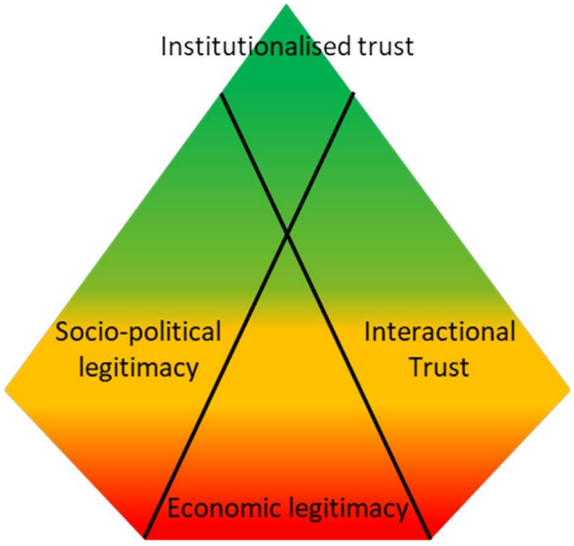
With a significantly greater number of urban people, it is difficult for producers to engage with the majority of them – let alone the geographic separation. It is unlikely to be enough get in front of the large and complex issues alone. The purpose is to give the public a taste of agriculture and attract people to the sector. However, I wanted to explore how agriculture could get in front of the societal and regulatory issues facing the industry.

More than just being viewed positively, agriculture needs to understand why it is valued and how it is relevant to the urban population. Rural New Zealand is unlikely to be central to kiwi culture and identity. While writing this section there was a window photo exhibition near the Beef + Lamb New Zealand of "kiwi dads". Not one of the dozen or so photos had a rural element to it. Perhaps farmer stories need to be re-focused to why it matters to the rest of society – not the farmer.

Public trust

While social licence to operate (SLO) is not the topic I sought to explore for my scholarship, it is important in setting the scene. I highly recommend Penny Clark-Hall's 2018 Kellogg Scholarship report as an introduction, which draws on the work by Robert Boutilier in particular. Figure 3 illustrates the three levels of the SLO pyramid, which are described in Table 1 (Boutilier & Thomson, 2011). Essentially, reaching green in the pyramid indicates reaching SLO – the more green, the wider the support for the organisation.

Figure 3 Levels of Social Licence with the Four Factors that Determine the Proportions of Stakeholders at Each Level (Boutilier & Thomson, 2011)



The first tier of the pyramid is economic legitimacy. Simply put, the observer benefits financially. Figure 3 shows that it is difficult to reach SLO purely by economic legitimacy, though with a high enough rating across the society in this aspect it can be achieved.

The second tier includes socio-political legitimacy and interactional trust. Socio-political legitimacy refers to the benefit to society in the relevant area, extending further than just economic benefit to the observer of economic legitimacy. Interactional trust is the reliability and honesty in exchanges, creating an experience of fairness.

The pyramid builds up cumulatively to institutional trust, where the sector becomes a well-regarded part of the society by the stakeholders with reciprocal goodwill. In Boutilier & Thomson (2011), 85% of

the cases showed were cumulative in building SLO that in reaching institutionalised trust, high perceptions in socio-political legitimacy and interactional trust are required.

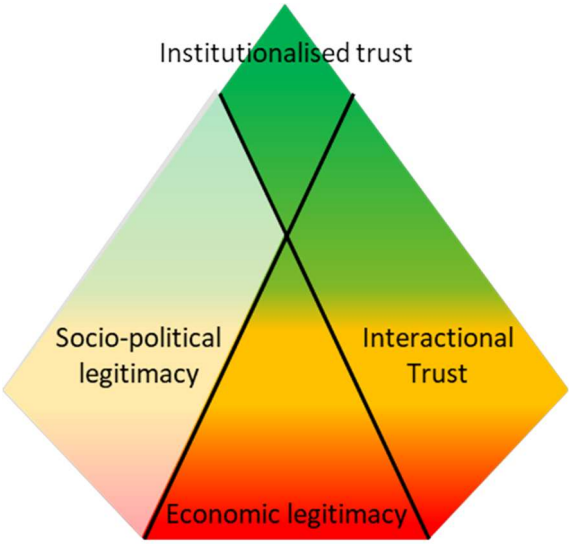
Table 1 Four Factors Constituting Three Levels of SLO (Boutilier & Thomson, 2011)

Level & Label	Description	Role in determining SLO levels as described in the Thomson & Boutilier Pyramid Model
1. Economic legitimacy	The perception that the project/company offers a benefit to the perceiver.	The perception that relations between the stakeholders' institutions (e.g., the community's representative organizations) and the project/company are based on an enduring regard for each other's interests.
2a. Socio-political legitimacy	The perception that the project/company contributes to the well-being of the region, respects the local way of life, meets expectations about its role in society, and acts according to stakeholders' views of fairness.	If lacking, approval level of SLO is less likely. If both this and interactional trust (2a & 2b) are lacking, approval level is rarely granted by any stakeholder.
2b. Interactional trust	The perception that the company and its management listens, responds, keeps promises, engages in mutual dialogue, and exhibits reciprocity in its interactions.	If lacking, approval level of SLO is less likely. If both this and socio-political legitimacy (2a & 2b) are lacking, approval level is rarely granted.
3. Institutionalised trust	The perception that relations between the stakeholders' institutions (e.g., the community's representative organisations) and the project/company are based on an enduring regard for each other's interests.	If lacking, psychological identification is unlikely. If lacking but both socio-political legitimacy and interactional trust are present (2a & 2b), most stakeholders will grant approval level of SLO.

There are the rare cases of non-cumulative institutionalised trust – without socio-political legitimacy. A strong perception of interactional trust converts into institutionalised trust. The exchanges and associations with the organisations are held in such high regard that it outweighs a lack in benefits to the wider society. However, socio-political legitimacy more often than not plays a role to achieve institutionalised trust and is likely to make this easier if included.

If we break the four elements into what industry has some control of or not, economic legitimacy and interactional trust are in some degree under control. Whereas, socio-political legitimacy and institutionalised trust are less so – some social good can be implemented on top the core roles of the organisation.

Figure 4 A Non-Cumulative Configuration of Factors: Hypothesised to Be Rare (Boutilier & Thomson, 2011)



Economic legitimacy is inherent to primary industries, particularly to rural communities and regional economies – even more so in New Zealand's economy.

Interactional trust is an area for industry to target. Trust is key in food production, not just between producers, the supply chain and retail and food service but government too (Brom, 2000).

In terms of food production, New Zealand rates highly including our government. So much so that the trust in New Zealand's regulation is an advantage for its trade-focussed production. New Zealand's agriculture exports benefit from this trust, such as more streamlined processes into major markets.

Socio-political legitimacy operates outwards in– reacting to the desires of wider society. As it is external to agriculture there is limited ability to influence and drive social change.

I had a few conversations regarding public trust with other Nuffield scholars – particularly from the UK - and often during my travels when discussing my project. It sounds comforting; but let us build trust so they give us the benefit of the doubt that we are doing the right thing the right way.

Looking back, this is the element that the agriculture can be the masters of its own destiny making it more attractive to target because we can do something about it. But this is only part of the equation.

We have more control on the transactional interactional trust. We can drive that. It is more difficult for agriculture to influence the perception socio-political legitimacy, which is driven externally.

But many of the wicked problems that are facing agriculture originate in the socio-political sphere – food movements, environmental concerns, food safety concerns, animal welfare expectations, etc – and the regulation driven from these concerns, despite the backing of science, facts and experience supporting agriculture.

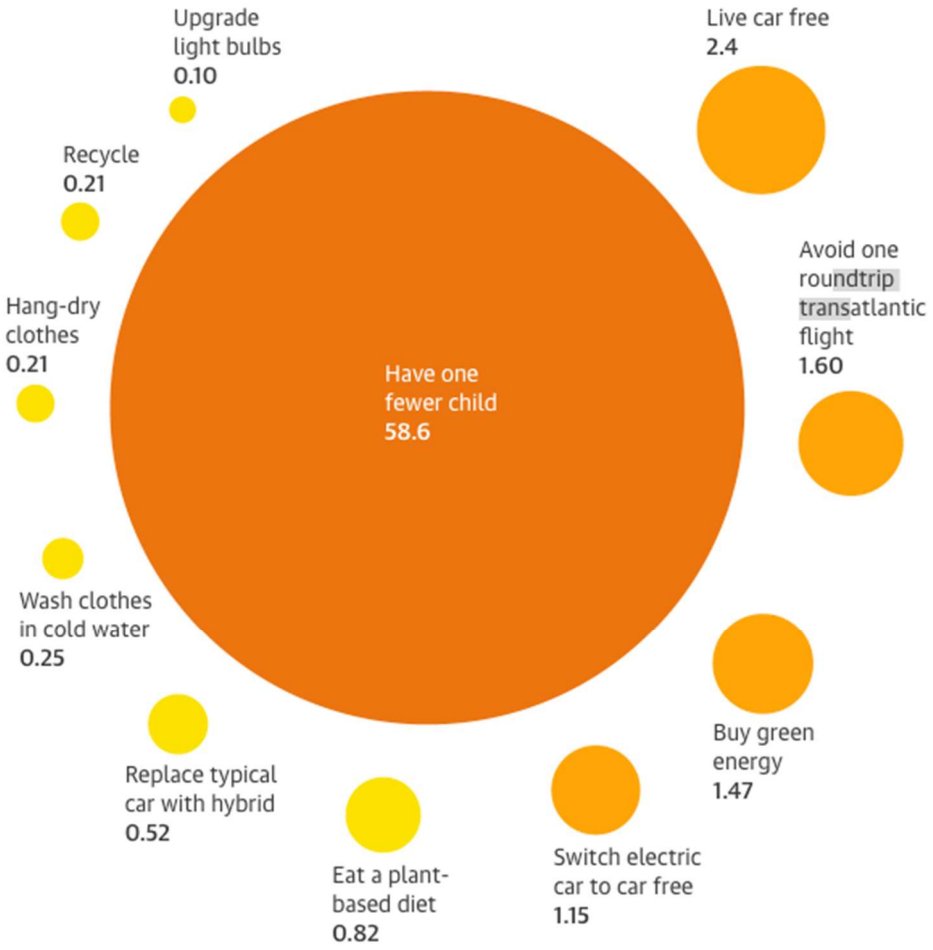
Getting ahead in front of the issue

The societal and political hurdles being put between agriculture and the consumer are large and complex – wicked problems. We need to be in front of them. If we are not in front of them, we are reacting to them. Because they are large and complex it becomes difficult and resource-intensive to be putting out large fires, which burn through public trust and goodwill.

Once the narrative has begun, it can be difficult to redirect the conversation back to facts. Tribalism around a desired social group or identity was very apparent in many of the stops on my Nuffield travels.

Cognitive dissonance is when someone holds beliefs, values or acts in a way that contradict each other. For instance, someone might identify as being climate change conscious yet have no problem travelling the world by air, knowing full well that it contributes to greenhouse gas emissions. Part of this dissonance can include self-justification or avoidance of facts to avoid the discomfort of their own contradiction. If these contradictory positions take hold, it can be difficult to turn them around.

Figure 5 Tonnes of CO2 equivlaent per one person undertaking each action ***Invalid source specified.***



Source: Guardian graphic

Prof Frank Mitloehner[2] spoke at the Contemporary Scholars Conference about climate change agriculture. He spoke at length about the focus of the public and policy makers on livestock agriculture, its perceived contribution to global warming, drivers of the public conversation, and the disproportionate targeting for achieving warming reductions. Figure 5 shows that five other actions have a greater benefit to emissions reduction than livestock farming, with the top three having at least double the impact – reduction in birth rates is over 70 times greater.

Yet, ruminant farming appears to get more attention in policy and public discourse. I feel this is largely driven by two similar reasons; it is seen to be less personal imposition, and politically to have a greater impact on fewer constituents – regardless of the impact. But despite livestock agriculture's ranking in terms of emissions, it features high in conversations targeting emission reductions.

So, how does agriculture build a fence at the top of the cliff and not have the ambulance at the bottom? Change is the only constant, so we need to build societal and political connections, empathy and trust to avoid conflict in the change rather than react to it. There are great resources in the rural leaders, particularly in programs such as Nuffield scholarships that give exposure and understanding of global issues, production and consumers. So how can these resources be best engaged to get agriculture ahead of the issues.

My initial objective was to explore how other sectors and industries pick up issues before they grow into wicked problems. I wanted to know what types of issues they faced and drove them to get front of them. The method of how organisations scanned the horizon was a focus but, importantly, the key and consistent elements that contributed to successfully heading off issues.

[2] Professor Frank Mitloehner. – Professor and Air Quality Extension Specialist, Department of Animal Science. University of California, Davis

Chapters 2: Scanning the Horizon

My explorations into "futuring" or horizon scanning covered many examples in a variety of contexts. There were a few consistencies across organisations. The type of people and expertise often came up as a critical element, regardless of the process.

In this chapter, I briefly summarise four different methods or practices that incorporated elements of horizon scanning. Some were suggested during other meetings or I had identified during prior to beginning my travels.

The venture capitalists

The venture capital sector is generally focussed on weighing innovative high potential growth against the high uncertainty and failure. I sought to understand their approach to minimise risk and considerations in approaching new opportunities.

The common theme that came through in the desired qualities was the people. While the concept, ideas and development of a proposed project were highly relevant, the team behind the project was often at the top of the list.

Sofia Ramirez[3] presented a ranking of aspects that were important when considering projects to fund. At the top was the people. Agfunder is focussed on agri-food technology.

Start-ups and small firms that are seeking funding present a technology or concept to apply to the agri-food sector. However, things can and do go wrong, such as the technology or the application don't quite align. However, by considering the people involved, the funded project is more resilient or adaptable to significant hurdles.

The limitation for agriculture highlighted in this approach was the built-in failure rate. Agriculture sector does not have this luxury. If there is a failure, either through not heading off an issue or it was a non-issue, then it is a waste of resources. The returns to agriculture are hard to quantify as high return since it is risk avoidance rather than gain. So, there is no offset for the losses and runs the risk of still losing ground.

Fernando Figueiredo[4] had a similar outlook as Sofia. In his work is scoping for Brazilian tech companies looking to expand into the US, the team matters. In the process of validating the technology and the application of that has been developed in Brazil, the concept can fall over – it's been done before, intellectual property issues, different legal environment or the demand doesn't exist. However, the right team can still succeed. Often by adapting the technology, developing a novel way to solve the same problem or attacking an entirely different issue.

In a meeting with a Scottish investment firm (which wished to remain anonymous), we discussed if identifying future issues was even the correct approach. Even if a future issue was perceived to be a risk, resourced and mitigated; is it possible to gauge the risk was genuine or it was a non-issue to begin with.

[3] Sofia Ramirez - Investment Associate at Agfunder. Santiago, Chile & San Francisco, USA
[4] Fernando Figueiredo - Chief Executive Officer at Oaktech, Founder of 415HUB. San Francisco, USA

With repayment for success to resource other issues and limited measures of success, justification to resource perceived future problems becomes difficult particularly when there will always be issues in the present.

The system of high-risk – high reward was not a good fit for agriculture. Importantly, the high priority on engaging the right people was the key takeaway, and more important to success. Setting up the right structures and tools for the right team is higher value than the original idea or concept.

Big data

Data monitoring or data mining came up in some conversations with agriculture industry. It was a tool that could be employed to detect issues on the horizon before they gain traction. These are unlikely to be done within agriculture. The organisations I met that used web analytics and data tools either had it as a core part of their business or bought "off the shelf" tools.

Amazon was the only organisation I met with that had in-house capability. Not only did they develop their own data analytics but are world leaders and this is a core part of their business.

How to make use of such an immense amount of data was core part of my conversations with Prof Gregory Duncan[5]. Domain knowledge (expertise) was crucial to develop the tools to produce results that are interpretable and can be applied to solve issues. The data can be easily overwhelming, so it is necessary to present it in a manageable format.

He cautioned that the agricultural expert is key to be involved in applying these tools to agricultural issues. It is easier to teach the subject matter expert how to use or apply their needs to the tool, than teach the technical model expert about agriculture.

Big data appeared to be a useful tool, and accessible, but it won't be of any use if you're not asking the right questions. This is a key role for rural leaders to play to be engaged in applying any data analytics tools to agriculture. Particularly those that understand the wider context agriculture fits into and what the conflicts may be present.

A necessary step would be a process to identify the potential points of conflict before employing these tools. A parallel can be drawn to policy development. A frustration with some of the regulation coming at the agriculture sector is not the objectives, but the lack of understanding of how it would apply on-farm, ineffectiveness in achieving the goals and unintended consequences.

Scenario testing

As I was focussed on picking up on issues in the future, I sought out different forms of scenario-testing; design thinking, foresighting, and scenario planning. Each process was based in the future and I wanted to explore them as tools to identify oncoming issues. I found the applicability of these methods to identifying issues facing the sector were limited.

As processes to define where you want to be going and what needs to be done to achieve it, they're invaluable. Planning and strategy are their purpose. The obstacles that get identified from these processes relate more to what needs to be achieved to reach the objective, or what is possible and impossible in achieving it.

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[5] Professor Gregory Duncan – Senior Principal & Chief Statistician at Amazon, Professor of Economics University of Washington. Seattle, USA

A common thread in these processes was the inclusion of values and principles in defining objectives for scenarios – putting the people in the centre of the purpose. Intersections of values and principles from the different stakeholders becomes a commonality to work towards in overcoming points of conflict.

Sarah Smith[6] highlighted that better buy-in can be achieved through a positive outcome. By focussing on servicing a common value of seemingly divergent groups, a wider consensus and input can be gained.

Expert panels

Expert panels came up time and again when discussing my project with agriculture industry leaders – often prompted by asking what their method was of picking up future issues in an ideal world. There are already numerous examples of industry leaders and reference groups.

JP Cativiela[7] described an example of an expert panel of dairy farmers leading in environmental regulation. In Central Valley, California, 91% of dairy cows are in 28 different counties, with over 50 different water, air and environmental authorities. The levy-funded Sector Sustainability Strategy advisory board advised Cogent in its project to simplify the environmental regulatory space.

A small group of dairy farmers was engaged to lead this project. In partnership with Cogent, they explored environmental risks and concerns – perceived, potential and real. A comprehensive report was compiled and, with industry backing, presented to state regulators.

Handing over a comprehensive list of environmental liabilities showed genuine leadership – the dairy sector was ahead of the regulators – and the transparency-built trust. Importantly they had a plan to act, which meant regulators had to follow or could be perceived as getting in the way of progress being made. This gave industry the ability to create a cohesive system across the 50-plus authorities.

Mr Cativiela advised that trying to address issues further than five years out was too much of a leap of faith for industry, making it difficult to get support. This was reiterated by Kyle Kretschman[8] of Amazon – issues may start to pop up on the horizon ten years out, become relevant five years out, and be acted on three years out.

Seafish – a UK-based levy-funded seafood body – employs a full-time horizon scanner, Dr Angus Garnett[9]. He has created a schematic that is periodically reviewed by a panel of experts. The risks are identified and changes in their priority gauged through continual peer-review by experts and research networks. Issues are categorised in macro conditions and range of impact, and the signals that elevate the priority of the issues.

When I interviewed Dr Garnett, they had identified 270 issues, 40-50 high priority or vocal issues that were further distilled down to seven for high impact and action. This emphasised to me the important role of expertise required to see the wood from the trees. Putting such complexity to committee, that includes lay people, could easily turn into an arduous process.

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[6] Sarah Smith – Research Director, Food Futures Lab at Institute for the Future. Palo Alto, USA
[7] JP Cativiela – President, Cogent Consulting and Communications, Inc. Sacramento California
[8] Kyle Kretschman - Market Trend Economist at Amazon. Seattle, USA
[9] Dr Angus Garnett – Head of Horizon Scanning & Long-Term Issues at Seafish. Scotland

However, not all suggestions were limited to industry or expert-led panels but to include the whole supply chain – including consumers – and often influencers. Joe McDonald[10] cautioned that influencers could either be principled or mercenary – both creating liabilities.

From Mr McDonald's perspective at Asda, the consumer was king and focus groups were an important part of taking in the range of views. Producers need to be part of the conversation, but he reiterated to get in front of consumer demands; listen, engage, and influence.

The customer is always right – Harry Gordon Selfridge, founder of Selfridge's Department Store

Mr MacDonald observed that it was difficult to engage public on a technical level and trying to engage at this level was a waste of bandwidth. Consumers demands of production were fundamental across the board, not just in the premium market.

This raised a question, if the customer knew what they wanted, how did they form these demands and opinions of food and fibre production? Is it possible to influence consumers and wider public at the start of this process?

Predicting consumer and public sentiment can be an early indicator but to separate the wheat from the chaff, expertise is always going to be needed. However, to get buy-in across the spectrum of stakeholders of food and fibre, we need to understand them. Mike Brady11 believed that they need to be involved; we need to understand, then we can build their trust.

As I explored how we could detect issues before they became wicked problems, often it felt like a punt – that it would be trying to back the right horse in the race to resource. Agriculture is caught up in the "now" issues, and resourcing future issues could be difficult, particularly when there are current conflicts to manage. Expert panels and focus groups can add value – and are used currently in many circumstances – but expertise is only a fraction of the decision making. Understanding the complexity, implications and prioritisation of future problems – the context – is not a straightforward process, but necessary.

If we pick up the issue early, can we even do anything about it? – Joe Burke[12]

The overarching objective is to ensure agriculture is involved in developing solutions for the wicked problems and in a position to lead. Even if rural leaders are successful in detecting these issues early on, it is still a reactionary response and potentially an adversarial stance. An alignment with other segments of society towards common goals, which rural leaders can bring them along with agriculture is a stronger position.

So, what tools exist for agriculture that can cut through to the opinion and desires of the wider society, to the underlying drivers? Can agriculture make what matters to producers and agriculture relevant to the rest of society to give them some ownership?

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[10] Joe McDonald – Corporate Affairs. Asda. Northern Ireland
[11] Mike Brady – Agricultural Consultant-Land Agent at Brady Group, Nuffield Scholar 2005. Ireland
[12] Joe Burke – Senior Manager of Meat & Livestock at Bord Bia, Nuffield Scholar 2015. Ireland

Chapters 3: Bioethics

The tools and methods explored in the previous section often require industry experts and leaders to be heavily involved, and often are still reactive to an issue. This lays a burden on the sector and reliance on industry creating an environment where agriculture is expected to do a disproportionate amount of work, and risks that we would forever be chasing our tails putting out fires.

Plenty of organisations take an offensive stance of being science-based or data-driven. Often, this is done to remove the emotive elements from a conversation that is against a practice or aspect of an industry. Yet, if conflict is due to a difference of values, then values need to be incorporated to truly resolve an issue, move past it or understand the root cause. If the values and facts can be put into the same conversation, then the conflict could be potentially negated altogether.

This is not to say expert-led discussions are without merit or don't play a role in bioethics, but there are alternatives. Rural leaders and experts can be harnessed to inform discussions and guide society and industry through these wicked problems.

Simply, in the previous examples the expert can be heavily involved as the leader and decision maker – a technocracy. While subject matter experts provide a high level of knowledge and detail, reliance on them runs the risk of decisions being made by narrow, authoritative viewpoints. Prof Mathias Kaiser[13] stressed early on meeting him that expert-led discussions were at risk of not creating good policy because purely factual reasoning could miss the need or objectives of the conflict or policy.

"What's the point of data without purpose or context?" – Professor Matthias Kaiser

With ethical frameworks, policymakers and regulators don't necessarily need to be the subject matter experts. They can create policy that is outcome driven. A situation where producers and rural leaders are a resource to inform policy, which achieves outcomes efficiently and practicably. Conversations become manageable and arrive at equitable outcomes.

Often the views of the various parties involved in an issue, technology or practice become broken down into quantifiable units – health, production, economics, safety, etc. A quantitative or fact-based approach may not arrive at a satisfactory conclusion on moral subjects, such as animal welfare.

Before progressing, Beekman et. al (2006)] highlights four key concepts in discussing ethical tools:

Ethics
Ethics as the common platform for deliberation and discussion of values in societies.

Values
Values as relational properties of states of affairs to which people adhere expressively as desirable.

Pluralism
Pluralism as the recognition that values differ in society, that these differing values need to be respected and taken into account in order to reach ethically acceptable resolutions of ethical issues.

Ethical tools
Ethical tools as practical methods designed to improve ethical deliberations by broadening the values considered and/or stakeholder involvement.

Adapted from Beekman et.al (2006)

[13] Professor Mathias Kaiser – Professor of Centre for the Study of the Sciences and the Humanities. University of Bergen

In a meeting with Dr Anne Barnhill[14], we began a conversation on the benefits of using bioethical frameworks and similar processes. What are ethics but an outcome of the belief, views or morals held by a group?

In thinking of where wicked problems arise and are driven from, understanding and conceptualising the ethics of external parties is valuable. Ethical tools can help to corral the diversity of beliefs and positions into a digestible framework for decision makers – or the agriculture sector – to harness.

A farmer will assess the benefits of a technology offers to their system, objectives – production, business or lifestyle – and consider the impact on their community and landscape. However, this is through their own perspective or values, which may not align with those held by the wider society and affected parties.

If the wider community feels agriculture is aligned with their values, they begin to be part of it and develop trust. This would be the inverse of a project I came across early on in my Nuffield journey.

While on the global focus program we were taken to a restaurant in Lexington, Kentucky. All but one of the staff were recovering from some form of drug addiction – including the owner. The initial focus is on creating a safe environment for continuing treatment.

However, the key element is prevention of relapsing. By involving the former addicts in employment and connecting them back into society, the likelihood returning to their habit is reduced. I had previously heard of research from Portugal succeeding with this approach, and the writer Irvine Welch describing addiction as an escape from a society the addict has no place in.

By giving the addict a stake in society, it gives them a reason to remain engaged. A method proven to succeed against recidivism, contrary to punitive measures.

An application of personal buy-in to a community was presented by Zespri at their European headquarters in Antwerp. Zespri's "Espacio Vitalidad" (vitality space) was created for their campaign in Spain – one of their significant European markets. This campaign centred around a concept of vitality – rather than purely on the product itself – creating a desirable association is flexible and relative to the participant.

The idea remains relevant to the consumer's values – what discerning cosumer doesn't want to have more vitality? The product is not primarily marketed on the qualities of the product but by the alignment to a value, which is malleable and relevant to the consumers own values. It is difficult to be critical of a relative and qualitative consumer value such as vitality.

[14] Dr Anne Barnhill – Associate Faculty and Research Scholar, Global Food Ethics and Policy Program. Johns Hopkins University

Optimal and equitable outcomes

Dr Barnhill broke down ethical tools, importantly, how these tools arrive at optimal or acceptable policy outcomes of the affected parties, creating a need for trade-offs between the interests of different groups.

The "fairness" of trade-offs depends upon the underlying values held by a group, and who disagrees on which trade-offs should be made. For example:

- economic justice and what are owed to sectors or communities;
- trade-offs between economic growth and societal goals;
- addressing present issues and needs of future generations of people; and
- welfare of people and animals.

Ethical tools – and transparent communication of their use and decisions made – can demonstrate that decisions made:

- can be justified by practices, technologies and policies;
- fully recognise the positive and negative effects on all affected groups, not just the impact on the observer's group;
- are rooted in values and recognise a group's responsibilities – not just benefits or costs; and
- recognise and respect all groups' values in making the decision – even if the decision is not supported by all groups.

Crucial to ethical tools is adequately taking in the "pluralism" of views. The sample of ethical tools I was presented with provide a framework to conceptualise this pluralism.

The use of these tools is not restricted to agriculture's position in relation to wider society, but also groups or sectors within the agriculture sector, which are not always aligned in objective and impact, despite co-existing and more often than not being intertwined. Ethical tools can be used to gain consensus across sectors to avoid contention or antagonism, potentially, a stronger, cohesive union for agriculture as a whole.

The conversations with Dr Barnhill – and later Prof Kaiser – highlighted additional use of these tools.

Tailored communication

Dr Barnhill proposed that exploring the pluralism of an issue or technology – and values behind these views – has the additional benefit of improving communication with groups of differing values. If we are telling the farmer's story from a farmer's perspective, then it is more likely to resonate with the farmer – but potentially not the target audience.

We discussed how this could apply to an issue that related to industry stakeholders on emotional level, rather than in a financial or production sense. The policies relating to afforestation in rural communities was topical, so we explored this matter. The coverage coming through at the time of this meeting in the USA was very much of how it affected farmers and their community.

How could this be perceived from wider society removed from those communities? Those impacts don't seem to affect them directly and planting trees to limit global warming seems a noble cause. Politically, it appears to affect a limited population.

Ethical tools could help to widen support by relating impacts outside of rural communities. If rural sector leaders go through the robust process of applying ethical tools to an issue or technology, then we can understand the perspective and underlying values of other elements of society. Armed with

this understanding we can communicate more effectively. Telling the farmer's story in a way that resonates with the audience – not the storyteller.

Our discussion around afforestation came back to how does this impinge on the values held by other parties. Ethical tools identify alignment in values between parties, and points of conflict between parties and the technology – in this case policy.

Driving change

Potentially, an ethical tool may arrive at an optimum policy outcome that prevents adoption or use of a technology due to the values held across society, despite the inherent benefits. If using a new or existing technology does not stack up as the optimal outcome of an ethical tool, then there is also a responsibility of rural leaders to communicate this back to industry.

However, if ethical tools were used in a proactive manner, the inherent plurality of potential topics of conflict can be understood. Taking a pre-emptive approach to long-standing or developing issues provides an avenue to drive change before antagonism arises.

For example, take a practice that is technically sound and societally beneficial but clashes on a values basis – such as the use of glyphosate, where production, food safety, environmental benefits are weighed against emotive and societal concerns. If an ethical tool was applied to the issue, then the points of conflict can be identified and understood earlier.

Societal pressures can be constructively incorporated into an informed debate. A debate that includes validated and quantitative evidence with the range of views – including producers and even non-human elements.
By understanding the beliefs and values that inform the contrary positions, it could be possible, to have an earlier conversation that accurately addressed contrary viewpoints. Essentially, moving how a society sees a technology, rather reacting to conflict over the technology.

There isn't a silver bullet of a bioethics tool that will apply to all issues, rather a toolbox to tackle a range of scenarios, technologies and issues. Beekman et.al (2006) provides a wider analysis of a range tools. Three examples of these tools that I encountered were the ethical matrix, ethical Delphi and reflective equilibrium. But before getting into a sample of these tools, it is necessary to consider how they are approached.

Systems-thinking

Systems-thinking is a key to approaching these ethical tools – and wicked problems. Using systems-thinking to explore the ethics of a biological issue or technology takes a holistic view. This contrasts with reductionist methods that break a system to its components, ignoring the interconnectedness that makes the system.

These concepts may not be entirely new to many industry stakeholders and leaders, but Dr Barnhill reinforced the importance of these bioethics tools when discussing the seeming wave of issues facing agriculture – particularly policy and regulation.

Systems-thinking is inherent in how agriculture operates – like many other businesses. However, a lack of this consideration in the wider environment in which agriculture operates may be a source of some discord.

Dr Barnhill highlighted some of the concepts that she considers are crucial to getting started in the systems-thinking "mindset". These are further explained in a series by Dr Leyla Acaroglu[15] (Acaroglu, 2017).

My introduction to systems-thinking had me considering if a lack of it had exacerbated the societal and regulatory headwinds facing agriculture. This was front-of-mind in our discussions and how applying a systems-thinking approach could benefit the development of policies that will have an impact on agriculture.

Four key concepts I felt were pertinent to the current climate of external pressure being exerted on the agriculture sector are; interconnectedness, feedback, causality, and emergence. This is a much wider and more complex field than these four concepts, but they are relevant to the current societal situation agriculture is facing in New Zealand and globally.

Interconnectedness

Connectivity is fundamental to systems-thinking. Nothing operates in a vacuum. For myself, this is a given in my background in behavioural ecology or for any farmer – feed budgeting, stock management, parasite control, the list goes on.

Agriculture is not a simple push-pull system of inputs and outcomes under the producers' control – even before the vagaries of weather and markets are overlaid. It is vital to understand the connections of an agriculture system – including regulatory and financial factors – before trying to influence a desired outcome.

Feedback

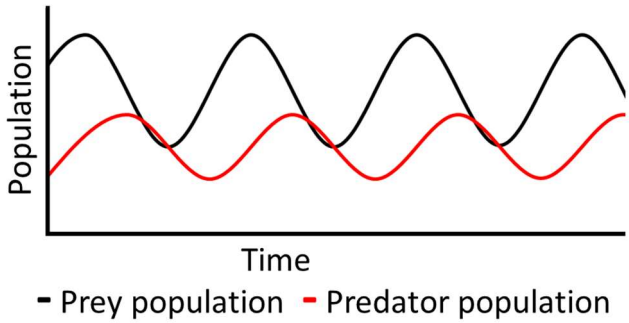
This holistic systems-thinking view is not static, the relationships are dynamic that influence – through feedback – on the components of the system and even the nature of the relationships themselves.

Dr Acaroglu identifies feedback in systems-thinking as balancing or reinforcing, which can relate to all connections. She used a population ecology analogy to illustrate the differences;

- Balancing feedback – stable but oscillating predator-prey dynamics like the classic Lotka-Volterra models (Berryman, 1992). The stable feedback loop of more prey providing more food for the predator population, more predators decreases the prey population that leads to a decrease in the predator population (Figure 6); or
- Reinforcing feedback – an imbalanced system where the predator is not limited by the prey population, which crashes, or the predators cannot limit the prey population that increases out of control

[15] Dr Leyla Acaroglu – founder of Disrupt Design, the UnSchool and the CO Project Farm

Figure 6 Lotka-Volterra predator-prey model (Stenseth, et al., 1998)



This resonates with my PhD research, which investigated predator interactions on predator-prey dynamics. Predator interactions can be:

- Complementary – the number of prey eaten by a combination of predators is the sum of prey eaten by predators in isolation,
- Synergistic – more prey is eaten by predators in combination than what is expected, e.g. the prey's response to attack from one predator species makes it more prone to the other predator species' method of attack, and the predators consume more than when hunting alone, or
- Antagonistic – interference between predators contributes to less prey being caught, e.g. the hunting method of one or both predators make the prey less available due to overlap in hunting method or the prey response to one makes it unavailable to the other.

Extending this analogy to policy development, employing systems-thinking could ensure policies do not only interfere with each other but get a result that is greater than the individual policies standing alone.

Causality

Building on feedback is a commonly understood concept of cause and effect. In understanding the system in question, it is critical to follow impacts of action throughout the different components and relationships within the system.

Potentially, policy made without a systems-thinking approach can create a system where policies create perverse outcomes, constrain the agriculture sector or work against other policies.

Understanding the causality of regulation of an on-farm practice is critical to policy success. Well-crafted policy would drive the goals to be achieved, and feed back into better buy-in from the farmers and industry to the policy.

However, policy created without understanding causality in practice – and feedback loops on other relationships – could limit a policy's effectiveness in reaching the objectives.
Due consideration to causality can avoid serious issues, such as limited acceptance by stakeholders as the practicalities of the policy are unsuitable, perverse outcomes or regulation running counter to other policies limiting the system achieving the desired objective.

Emergence

Essentially, this is the sum of the parts. The desired outcomes and what it means for the stakeholders of the system. Importantly, understanding the emergence of a system helps to know why it is at its current state.

A systems-thinking approach improves the ability to achieve the desired outcome from the system by understanding relationships and processes within the system.

A prescriptive input focus can create inefficiencies in reaching goals. Piece-meal policy and isolated actions create significant problems as directives converge at the point of implementation and the emergence is unknown. The objective of producers becomes conforming to what has been prescribed – rather than the desired goal policy.

Harnessing the agriculture sector's understanding of their system is a powerful tool. Farmers are innovative. Responding to a variety cues, farmers have adapted and evolved to maintain profitability and achieve personal aspirations – such as family, environmental and community benefits. Engaging this expertise in policy development rather than at implementation is more likely to achieve the desired emergence.

A lack of systems-thinking could explain a significant source of anxiety for agriculture. With so many proposed external burdens coming at the sector, it becomes difficult for producers to see the wood through the trees and risks disengagement.

The expertise within agriculture is a significant lever to use in addressing many wicked problems facing society – particularly in environmental issues – due to the amount of area that farmers manage and their interface with that land.

A lack of clarity and cohesiveness across policies becomes a liability – to the success of individual policies and the emergence of the system. Systems-thinking is a comprehensive exploration of a system but becomes unwieldly – though techniques exist to limit the complexity of systems. It's an extensive field with a range of philosophies and methodologies from many perspectives.

The key takeaway is the holistic mindset. Not just in approaching bioethics, but as rural leaders that encourage this mindset in stakeholders and external parties.

Instead of policy coming to a head at the farm gate – for the farmer and industry to disentangle the impacts and outcomes – it must be developed in a cohesive manner that achieves the desired goals efficiently. Potential overlaps of different policies become synergies rather than applying multiple methods for the same result – or worse, working against each other.

Chapters 4: Bioethics Tools

In this section, I've used the ethical matrix to introduce core concepts and uses of bioethical tools as it is a foundational tool. There are many other examples and this report does not aim to present an exhaustive list, nor tutorials. Following the ethical matrix case study, two more tools are explored: the ethical Delphi, and reflective equilibrium.

The ethical matrix

The first ethical tool that caught my attention was the ethical matrix during a presentation by Dr Barnhill. Initially, my thoughts were this could be used to frame-up some of the complex wicked problems facing the sector. It does. But it can be used for much more.

The ethical matrix has evolved since its original development by Prof Ben Mepham[16] in 1994. Prof Kaiser has worked alongside and often published with Prof Mepham on this topic. He has applied ethical matrices to a range of issues and projects, and co-author for the Ethical matrix manual (Mepham, Kaiser, Thorstensen, Tomkins, & Millar, 2006).

In considering a technology or practice – existing or new – the ethical matrix was created to facilitate regulation and policy arriving at a balanced decision that considers the viewpoints of all affected parties.

It's designed to be an accessible tool for the layperson or decision makers – not for purely academic purposes. The principal output is an inventory of the plurality, consensus or alignment of parties, and divergence of ethics and potential points of conflict.

The ethical matrix does not make the decision but aids the decision maker. A solid and broad foundation for arriving at an optimal decision is created because the ethical matrix presents the plurality of both; perspectives and concerns. The ethical matrix largely takes principles at face value and errs on the side of caution. However, the process provides opportunity to counter principles through deliberation.

The information that is considered includes (Mepham, Kaiser, Thorstensen, Tomkins, & Millar, 2006):

a) scientific and economic data;
b) assessments of the consequences of risk and uncertainty;
c) assessments of the intrinsic value of different forms of life; and
d) tacit, folk or practical knowledge

Point (a) incorporates quantitative research and evidence.

Point (b) is based on the precautionary principle –a principle that raises risk, at face value, in the context of the assessment, the onus is on it to be proven safe.

Point (c) introduces values of the variety of species. This brings in non-human values and the values species have to other parties (as in the following case study).

[16] Professor Ben Mepham – Professor in Applied Bioethics: University of Nottingham

Point (d) includes qualitative principles based on cultural or industry knowledge. Applying this to a New Zealand agriculture context, it would include tikanga Māori and farmer knowledge that may not be held in a quantified form.

A template of the ethical matrix is a relatively simple layout. Overlaying rows that represent different affected parties are three columns for over-arching principles; wellbeing, autonomy, and justice (Table 2). Principles and affected parties can be added or amended from the generic example given.

Table 2 Generic example provided in Ethical Matrix Manual (Mepham, Kaiser, Thorstensen, Tomkins, & Millar, 2006)

Respect for:	Wellbeing	Autonomy	Justice
Producers	Satisfactory income & working conditions	Managerial freedom	Fair trade laws
Consumers	Safety & acceptability	Choice	Affordability
Treated organisms	Welfare	Behavioural freedom	Intrinsic value
Biota	Conservation	Biodiversity	Sustainability

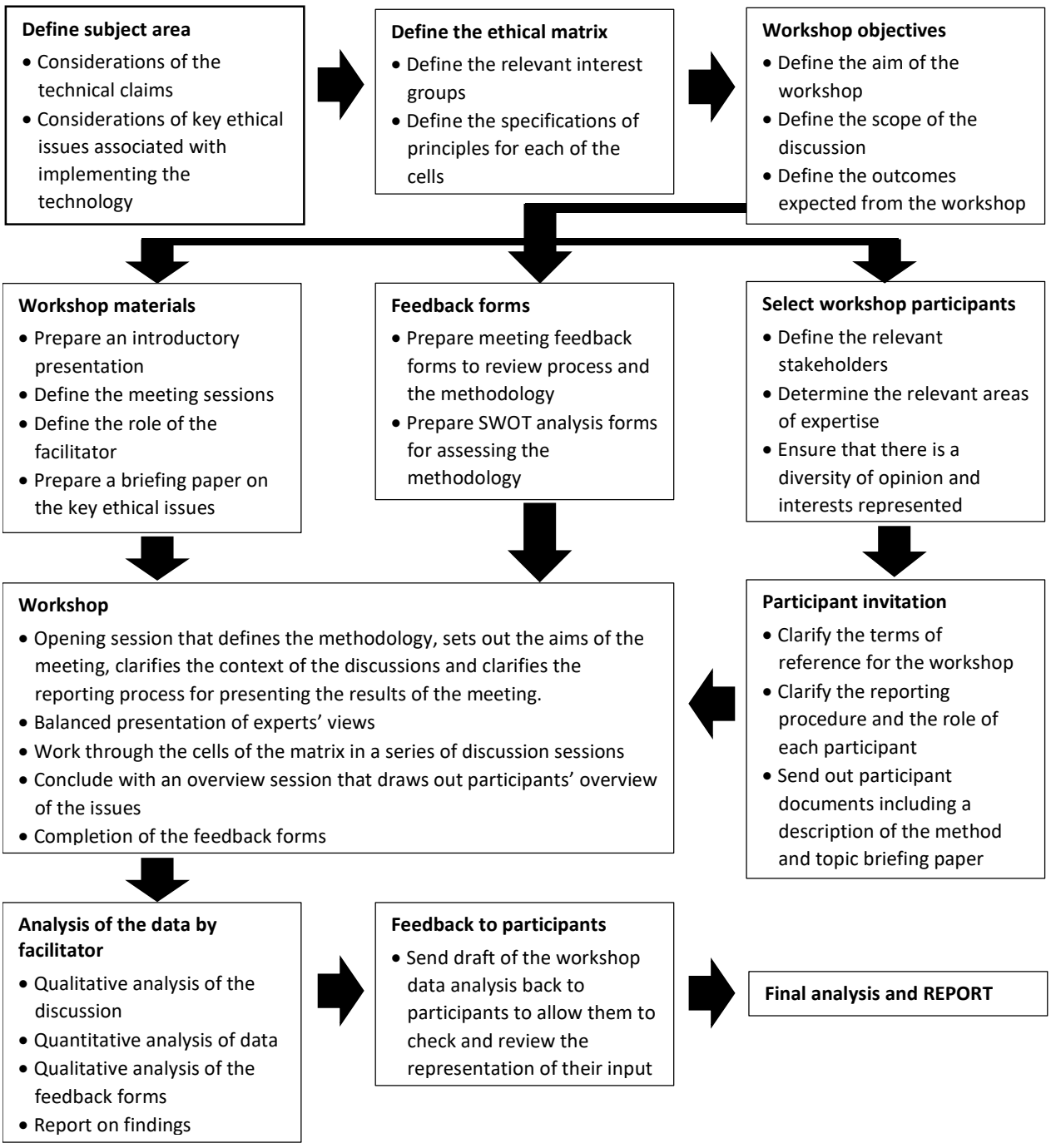
A key advantage of the ethical matrix is the process does not necessarily require engagement with all affected parties. Potentially, it can be undertaken by a single person or a distinct or internal group. However, the quality of the matrix's output is only as good as the inputs, highlighting the importance of a systems-thinking approach and self-reflection of the user.

Transparency is crucial to giving an ethical matrix credibility. Giving air to the plurality of principles gives the deliberation process robustness. The transparency of process is valuable to communicating any decisions made.

The more explicit and relevant the principles are to the technology, the more useful. The better the understanding that decision makers have of all the arguments, the more robust the outcomes will be. Ill-defined points provide less assistance to deliberation and make relevant comparisons difficult.

A scoring system can be applied to the matrix rather than a simple positive/negative/neutral to add more definition to the deliberation – the scale of definition is up to the judgement of the decision makers. However, a scale may not be necessary, and a deliberative process may suffice depending on the purpose. The matrix becomes an aid to structure discussions. Figure 7 lays out a simple process that can be modified to suit purposes or resources available.

Figure 7 Summary of a generic protocol of the Ethical Matrix ***Invalid source specified.***



While I was visiting Prof Kaiser, the debate around using genetic modification in New Zealand's agriculture had risen in visibility as a method to reduce livestock greenhouse gas contribution. He had previously applied the ethical matrix to a similar issue in Norway. He is working with New Zealand's Prof Sir Peter Gluckman, former science advisor to the prime minister, exploring future scenarios of technological developments in New Zealand – such as genetic modification. He described work he was involved with in Norway exploring the ethics of using genetically modified salmon.

In 2011, three workshops were run in Germany, Norway and the UK to explore the plurality around using genetically modified growth enhanced-salmon in aquaculture. From a technical perspective, GM salmon was nearing a stage where commercialisation for aquaculture systems for human consumption could begin. GM has been a widely debated topic. Uncertainties and perceived risks in the public domain have thrown up plenty of controversy. The ethical matrix was used to structure this debate in the three workshops.

The affected parties used within the matrices were pre-described to represent the entire supply chain. Two of them were non-human;

- The scientific community
- The environment
- The engineered salmon
- Salmon producers (aquaculture)
- The wider seafood sector (suppliers, processors, wholesalers, etc)
- Consumers and citizens

The participants were selected within each country to try and get representation across all six affected parties. This was not always possible and highlighting a potential limitation of the ethical matrix.

I raised with Prof Kaiser, whether there are risks associated with not including the spectrum of affected parties. A practice or technology may be accepted within the sector, but little is known of how it may be received by other affected parties so an ethical matrix could be appropriate. But by introducing participants that hold different values, it may hasten the technology coming into the public domain.

For example, if a sector wanted to explore a sensitive or contentious issue that was on the horizon. To understand the plurality without lifting the profile – like an existing practice that may raise concerns.

In discussing this with Prof Kaiser, he reiterated that transparency was an advantage of the process. If the outcome of the process is unpalatable, then it is unpalatable. But, the sector would be in a position to lead – as in the example given Mr Cativiela, where the dairy sector led on environmental concerns. Sector leadership is key to managing this risk. Also, it is not necessary to include antagonistic perspectives but representative. Therefore, the affected parties' views do not need to include the extremes of the plurality.

Alternatively, the ethical matrix could be kept internal, akin to doing the ethical matrix as an individual. Self-reflection and systems-thinking are crucial to the process providing. Decision makers and observers would need to be conscious of deliberation limitations.

Participants were briefed a week prior to the workshops with the ethical matrix format and a range of the quantified and qualitative information available. The process followed Figure 7, then findings of the workshops were delivered to policy makers of the European Commission.

While deliberations discussed the pros and cons of the technology, there was clear feedback against the GM salmon to be used in commercial aquaculture – which was communicated to the European Commission. Interestingly, this sentiment was counter to a process undertaken by the U.S. Food and Drug Administration, which had undertaken a more scientific and quantitative analysis.

Prof Kaiser noted that often where the deliberations differed between the workshops was when there were experts present in certain fields. The discussions around their field of expertise were covered more thoroughly. Care needs to be taken in participant selection or by facilitators that conversations are not overrun by select expertise.

Prof Kaiser reiterated that a key advantage is that laypeople lead in the ethical matrix and have the deliberations. Expertise can be used to inform the debate, not drive the process.

This came through in the workshops, that benefits to the science community was one of the main advantages. Value was given to advancing the research field, and the opportunities and interest that commercialisation could bring.

However, the prioritisation of the scientific community was often seen to run counter to some of the other affected parties. An example was genetic modification investigation driven by scientific interest, but this distracted from research into parasites and disease – issues that were currently at the forefront and priorities for other parties (producers, environment, and the fish). Curiously, uncertainty was a big driver of the negative outcome of the workshops towards the technology, but certainty could be gained by giving more weight to the scientific community. Almost a "catch 22" situation. The precautionary principle is central to the ethical matrix – the default is to err on the side of caution.

A lot of deliberation centred from the perspective of the salmon, perhaps because or despite it being one of the two non-human parties. There were few clear benefits to both the salmon and the environment, yet it generated a lot of uncertainty for the deliberations.

In environmental policy proposals facing New Zealand's agriculture currently, a process akin to the ethical matrix would have been valuable and effective. "Hold the line" (preventing further harm to the environment) has been a common thread in these proposals, and the precautionary principle has played role in forming some of the policies. It is understandable that this approach of halting any further environmental damage and protecting what remains has occurred.

However, working from an industry position, policy development appears to have taken a narrow perspective. The case study of GM salmon presented by Prof Kaiser showed the importance of including the plurality – especially on contentious and complex issues – and the strength of outcomes.

The ethical matrix provides a tool that has democratic and inclusive inputs, and outputs. The tool does not arrive at decision but informs a structured debate to inform decisions. The process doesn't diminish the relevance of the environment as priority can be assigned. The importance of the precautionary principle in the ethical matrix provides protections, along the lines of "holding the line".

The transparency of the process provides improved buy-in from the range of parties. Even if the views of a party are outweighed in deliberations, an opportunity is given in this transparent and inclusive process. There is a current feeling of producers and industry being dictated to rather than utilised as a knowledge source and partner.

Additionally, the process gives the "constituents" of agriculture an opportunity to be united. Agreement across the board will not always be achievable but going through a fair and representative process can help to prevent antagonism within agriculture.

It is valid to go through the ethical matrix process as an individual or within an organisation can to understand the wider concerns of an issue. Creating an inventory of the plurality of views helps the agriculture industry to prioritise or address issues.

Importantly, as an industry, we can be more effective in addressing concerns or antagonistic views. Not only are we better informed where the points of conflict are but the values behind these conflicts. Making communication more relevant to the audience – creating potential to pre-empt conflict, or at least being informed to how other affected parties may react to issues as they arise.

The ethical Delphi

The second method that Prof. Kaiser took me through was the ethical Delphi, which is a tool that is more suitable for deliberation and discussion between experts and technicians – rather than the lay-person decision makers. It can be used in conjunction with the ethical matrix to better inform decision makers.

The Delphi method has been widely used in various applications since development in the 1950's to evaluate the plurality around a new technology by experts. The ethical Delphi has evolved out of this original form.

Like the ethical matrix, the ethical Delphi does not make the decision for the decision-makers – but provides a format to bring rationalised expertise to inform decision-makers.While the matrix seeks a comprehensive inventory of all the issues, the values behind them and conflicts of all parties – the Delphi is more directed towards facilitating discussion amongst experts.

In terms of outcomes, both tools promote deliberation of principles, structures an informed conversation and identifies the points of conflicts. The two key differences in outcomes of the ethical Delphi from the ethical matrix are:

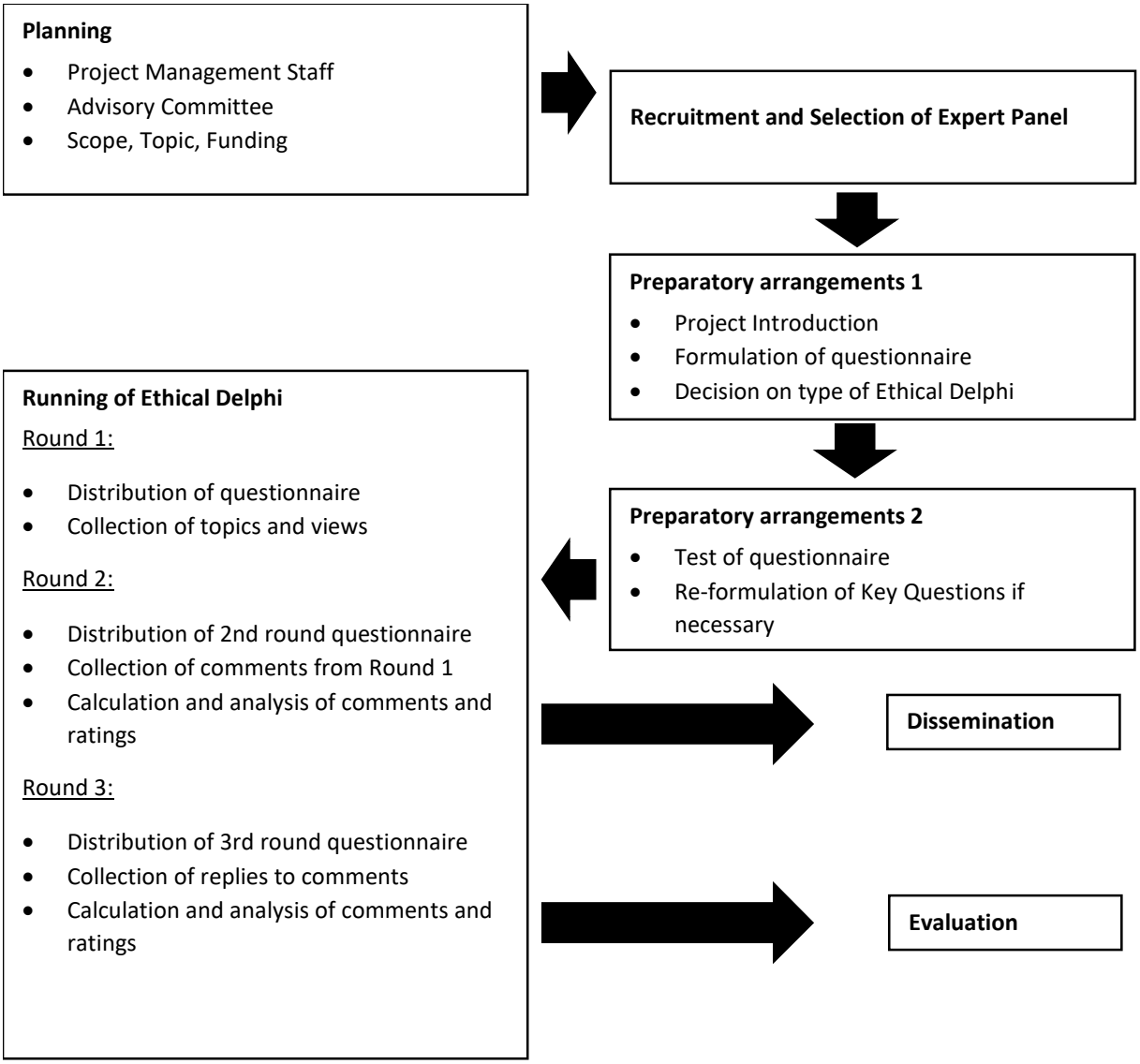
- Seeking value assessments of experts regarding the technology or issue, and
- Categorising the degree of alignment and disparity in the views of experts.

Many of the benefits derived from the ethical matrix and purpose overlap. Both provide a summary of the issues and associated values for a given technology or practice, identify the points of conflict and assign priority to these principles.

The ethical Delphi is built around an anonymous "virtual" committee. The anonymous aspect is critical to this process. Any hierarchy or existing personal relationships that could influence or prohibit deliberation are removed.

The process is iterative with multiple rounds of feedback (Figure 8). Participants can refine or even change their position based on the feedback that is given throughout successive rounds. The anonymous element of the process can make this more palatable to the experts involved. Changing a position often becomes easier if the prior stance isn't public, or the amended anonymous position doesn't contradict historical public stance.

Figure 8 Key steps in an ethical Delphi (Millar, Tomkins, Thorstensen, Mepham, & Kaiser, 2006)



The feedback is managed by the process' facilitator. After participants have had the opportunity to revise their previous evidence and positions, the round of feedback is summarised. An opportunity to review and reassess is provided in the next iteration.

The process involves a questionnaire that is provided to the participants, this is detailed in Millar et al (2006). Definitions, framing and scope become very important for managing participants and keeping the discussion focussed. Initially, questions can broadly be either;

- Open-ended, which gives participants an opportunity to present issues to be incorporated into the process, or
- Closed questions or statements, which are defined by the facilitators. Caution needs to be taken with this style as it can stymie deliberation and the facilitator's presumptions could weigh on the outcomes.

Each iteration is informed by the previous and continues until agreement is deemed by the group to have been reached. How each issue is explored can evolve, for example; going from a closed to open question to exploring the plurality further, or open to closed to firm up a position.

Prof Kaiser used an example from Millar et al (2006) to show how the questionnaire can be narrowed down to closed question as the process is progressed (

Table 3).

A consensus for the process is needed so the process can be completed, and results settled on. However, there is no standardised definition of consensus, but the ethical Delphi generally becomes more stable after each iteration.

Table 3 Generic example of closed question

Degree of agreement					
1	2	3	4	5	6
Degree of self-assessed knowledge					
1	2	3	4		
Comment:					

Degree of agreement	
Strongly agree	1
Agree	2
Slightly disagree	3
Disagree	4
Strongly disagree	5
I have no opinion	6

Degree of self-assessed knowledge		
Very familiar	You actively work in this area or with these issues	1
Quite familiar	You are not working in this area, but you are well informed about arguments dealing with the issues	2
Not very familiar	You have read only a few articles in the news media (newspapers, magazines, television, the Internet) about these issues	3
Unfamiliar	You have very little or no knowledge about the issues	4

Prof Kaiser emphasised the strength of the ethical Delphi to bring experts in a field – without physically bringing them together. The crucial element is anonymity to remove the risks of stronger personalities or those held in high regard from dominating the discourse. The anonymous nature of the tool makes it easier for those who have made a position not lose face by being swayed by the discourse.

Practically, this provides an avenue for industry to engage a spectrum of experts in a confidential manner and hold the reins of the conversation. The first application that came to mind is policy proposals and the debate around freshwater.

Scientists and experts that may have had public positions against agriculture can be folded into a debate. By including them to reach consensus, a reasoned and well-founded scientific position can be taken on the issue.

Using this tool in combination with others like the ethical matrix to incorporate other affected parties – tikanga Māori, producers, communities and consumers – strengthens the quality of deliberation, and soundness of policy and positions on some of the wicked problems.

Reflective equilibrium

The third example of bioethics tools is applying the reflective equilibrium method to bioethics.

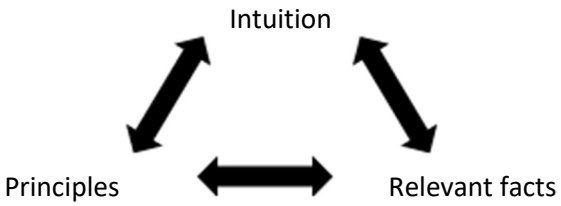
The method is built around back-and-forth interactions between intuition, the relevant facts and principles to arrive at a reasoned moral judgement (Figure 9). As the method is built on feedback, the ethics of the observer can shift.

It begins with making the moral intuitions of the observer or participants explicit. This is tested against the facts that are relevant to the subject matter and the statement of intuition. Then, moral principles that relate to the statement can be overlaid on the statement.

The moral intuition incorporates moral experience – whether based on experiences within the sector or the perceptions from the outside. This original statement can be influenced by either relevant facts or principles, often a point of integrity can be a starting point. If the statement is augmented, it feeds back to new facts or principles that could now correspond with it.

The reflective equilibrium is designed to explore complex moral and ethical issues. It can operate in multiple disciplines and moral values to provide a validified moral judgement.

Figure 9 Reflective Equilibrium reasoning



Dr Bernice Bovenkerk[17] and Dr Franck Meijboom[18] both suggested the reflective equilibrium as alternative to the ethical matrix.

Dr Bovenkerk is the secretary and Dr Meijboom the vice-president of the European Society for Agricultural and Food Ethics (EUR-SAFE), which Prof Kaiser is a former president and Prof Mepham a founding member. EUR-SAFE was created 1999, bringing together a range of largely Northern European scholars working major agricultural issues. The society has three objectives;

- Encouraging international academic research and education on the ethical issues involved in agriculture and food supply,
- Encourage exchange of professional experiences and training approaches related to ethical issues and capacities,
- Encourage international scientific and public debate on the ethical issues involved in agriculture and food supply.

Dr Bovenkerk uses the ethical matrix in her university teaching but generally as an introduction to the field. She viewed the matrix as a good starting point to gain all views and delay confrontation. Dr

[17] Dr Bernice Bovenkerk - Associate Professor at Social Sciences Group, Wageningen University, and Secretary of EurSafe. Netherlands
[18] Dr Franck Meijboom – Associate Professor of Ethics of Human-Animal interactions, University of Utrecht, and Vice-President of EurSafe. Netherlands

Meijboom viewed the matrix as limited to an inventory and other tools and methods provide more facility.

Dr Meijboom stated that too often the professional and corporate realm run the risk of missing subtleties of a complex issue – or wicked problem – by defaulting to a factual debate. The reflective equilibrium provides a tool incorporate relevant facts and moral principles to come to a truly principled and factual position.

The more esoteric element of this method is the moral principles that apply to an issue, which I perceived to be the main hurdle to using the tool. Fortunately, there is often existing constructs that can be used. Dr Meijboom had applied the reflective equilibrium to veterinarian ethics. The principles that were applied in this case were;

- Beneficence
- Non-maleficence
- Respect for animal integrity

Beneficence and non-maleficence cover aspects of animal welfare, essentially; beneficence is health and well-being of the animals, and non-maleficence is preventing harm. Animal integrity entails that an animal is more than just its utility or service to humans.

If the reflective equilibrium model was applied to a new technology relating to animal welfare considerations in New Zealand, the moral principles are already agreed that provide a starting point. There are the five freedoms in the Animal Welfare Act 1999;

- Proper and sufficient food
- Proper and sufficient water
- Adequate shelter
- The opportunity to display normal patterns of behaviour
- Appropriate physical handling
- Protection from, and rapid diagnosis of, injury and disease

Through each iteration the reflective equilibrium comes to a balance between the three inputs to arrive at a moral judgement. A judgment is not a fixed position. As better information is available or the moral principle evolve, then judgment could move. The original judgment becomes the starting statement.

Dr Bovenkerk stated that – if done properly – the process can lead to counter intuitive judgments. If the starting intuitive started is not supported by facts or is not in line with the moral principles, then it will be borne out of the reiterations a judgement that is in balance with the relevant facts and principles.

My first impression of reflective equilibrium was that it is far more philosophical than the two other tools and gave me reservations about its applicability to applied agriculture issues. This method does require more in-depth understanding of the topic by the facilitator than the ethical matrix and ethical Delphi. However, other bioethics tools can be used to better inform the reflective equilibrium. For example; the ethical matrix to inform the plurality of moral principles, and the ethical Delphi to use expertise to inform the relevant facts.

Principles was the element that I initially thought to be impractical outside of academic practices. However, often there are already constructs established, such as the animal welfare act or tikanga Māori.

As the model progresses through iterations, some additional principles and facts may be included as the intuitive statement amended through the feedback. A poorly designed or biased process can become just a method of self-justification and nothing is gained from the process.

The reflective equilibrium can be used to explore morality of a practice, potentially of other interest groups on complex topics. The systems-thinking approach is key to arriving at a sound position at the end of the process.

I can see great value from the process in applying as in an early stage to define what the objectives of a policy or a position an organisation takes. Taking a purely factual and scientific or an emotive stance can leave the organisation or sector in a vulnerable or irrelevant position on an issue.

Three different bioethics tools were touched in the section, which by no means comprehensive. While there is overlap in each method and uses, each has suitability for different objectives. Each tool is more appropriately applied to address issues for differing ways, such as;

- Ethical matrix to understand the range of views and values underlying these views for all affected groups,
- Ethical Delphi brings together expertise and arrives at a reasoned consensus through reiterative process, and
- Reflective equilibrium can resolve moral principles, relevant data and research, intuition and expertise in context to form an optimal, reasoned and relevant position.

This section sought highlight the field and expose the potential of bioethics tools as a pathway to get ahead of issues facing sector. This is not by detecting issues before other parties but understanding the range of values that can drive the issues and putting the knowledge we have into a relevant context. The right tool for the right job is vital – and knowing how to use it. It would be unreasonable to expect rural leaders to know and understand the full gamut of bioethics tools.
In adopting these practices, engaging with the authorities on the topic as guides and trainers is a first and essential step.

Chapters 5: Conclusions

Rural leaders not only have a responsibility to the agriculture industry and rural communities, but also to society as a whole. I set out to see how the agriculture industry can get in front of society, but that mindset is based on some level of separation between agriculture and wider society.

The definition I gave for wicked problems was difficult to define with no right or wrong solutions, which are difficult to test, and often a result of other issues (Stony Brook University, 2020). Bioethics tools can be added to the toolbox of rural leaders to understand the range of potential drivers. Not all bioethics tools arrive at a decision or solution, but they provide decision makers the ability to arrive at reasoned, optimal and strategic solutions across all affected parties.

The bioethics tools explored in this report give a taste of pathways to bridge the divergence between agriculture and wider society. Appropriate use of a suitable tool can help to understand the root cause of a potential conflict, rather than attempting to be first to detect the symptom.

These tools would position rural leaders at an important confluence of society, putting them in place to not only lead rural communities and industry – but society as a whole. This does not mean that it is purely agriculture's responsibility but the opposite. Identifying shared values and objectives engages large societal structures – like government – to work towards equitable outcomes – including for agriculture.

Agriculture is a foundation that modern society is built on. Without efficient and reliable production of food, society cannot have its cities, universities, hospitals and stable governance. Consequently, agriculture underpins a functioning society and cannot be separated.

By seeking to get ahead of other segments of society, there is an implication that agriculture needs to overcome them. Rural leaders have a wider reach and responsibility than their immediate community - and successes are shared between urban and rural communities.

Many would already hold that view but that is contradicted by the present wave of societal and regulatory pressure facing agriculture. By understanding the values of other segments of society, rural leaders can understand the relevance of agriculture issues to wider society.

I see the role of bioethics tools being wider than just specific technology or practices. There are potential applications to broader topics involving agriculture, or even agriculture itself. Instead of public surveys rating the approval of agricultural sectors – as in the Ministry for Primary Industries survey - an understanding of why agriculture is valued and what values are desired. Essentially, rural leaders could explore why the wider society should be invested in agriculture and why it should matter to them.

The tools and methods that I explored to identify future issues still have their uses. They will have their place and can work in conjunction with the bioethics tools. However, they are essentially still reactive: an ambulance at the bottom of the cliff rather than a fence at the top, only, the ambulance gets there earlier.

I have already adapted the ethical matrix in my regular work for a different purpose. One of my current projects involves engaging with a variety of stakeholders. I have developed a model that incorporates a few assumptions so the future direction of the sheep and beef sector can be established. Then, scenarios were created with more assumptions and tested through the model.

A big concern with this work is external stakeholders being distracted with details of the model and assumptions made, rather than focussing on the objective. The modified ethical matrix not only helps ensure that all the assumptions are sound but presents them in a comprehensive and transparent way to all stakeholders, thus advancing the conversation and project.

Agriculture sectors know themselves well, but ethical tools can help the sectors to better understand how agriculture fits into wider society. If we take an issue or technology and simply apply those benefits in a purely factual production setting, we risk alienation from wider society.

The application of bioethics principles and tools into some of the wicked problems facing agriculture and rural communities is encouraging. Bioethics tools gives rural leaders the ability to gain an accord within the agriculture industry, amongst experts, and across society. These tools create potential alignment for rural leaders to extend into the wider society to achieve common aims.

The wicked problems facing agriculture may never be truly solved, but these tools provide a method to move forward by developing an understanding of the views and values, reaching reasoned positions of expert advice, and putting this knowledge in the context of societal values to build optimal solutions. In understanding and addressing the wicked problems facing agriculture, rural leaders become leaders for all by ensuring rural communities' relevance to the wider society.

"Beating" other stakeholders to potential issues was an inappropriate approach. Aside from being a risky and resource-intensive approach, through my Nuffield research I found it is still reactionary and does not bring other affected parties along – with rural communities and agriculture industry. This approach risks agriculture being in a position of adversary – rather than leadership – in solving the wicked problems.

Fostering a systems-thinking approach amongst stakeholders and interest groups around agriculture could have mitigated some of the current issues. The lay-person or policy maker does not need to have a thorough understanding of agriculture but be aware of the complexity of the industry and their own regulatory space, relying on rural leaders as guides and experts.

Creating pathways with bioethics tools will help agriculture establish a reason why other segments of society should be invested in rural communities and agriculture, by understanding their underlying values. This understanding highlights convergence of values and objectives in a transparent manner, and, importantly, potential points of conflict. Armed with this knowledge and these tools we are better placed to arrive at a consensus and communicate in a manner that is relevant.

Engaging with experts in bioethics tools and developing an industry toolbox for different purposes and scenarios is key. The field of bioethics is broad, and I have only been exposed to a small sample. Much like rural leaders are experts of their domain, developing relationships with academics and practitioners in bioethics is necessary – not only to find the appropriate tool, but its appropriate use.

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