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FINANCIAL IMPLICATIONS WITHIN AN ENVIRONMENTAL CONTEXT
subtitled "Show them the money"

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In the 35 years of FLRC conferences, Nutrients and Management have each featured 16 times in conference titles. Production (twice) didn't make it through to this century. Efficiency (four times) has spanned the decades and last year we had 'solutions'. This year we have 'opportunities'. Throughout the years scientists, rural professionals and farmers have been focussed on identifying ways of improving food production and land management. Policies (regional and national) have appeared in many papers and both 'policy' and 'compliance' have appeared in pre-Covid conference titles.

In only one of the conference titles have there been words linked to economics, finances or business viability. This is the bottom line for any suggested change for the farmer, the owner of what is fundamentally a small to medium business (which might or might not enable a pleasant lifestyle), that makes the difference. None of the programmes, models or even pieces of empirical field research can work unless there is a bottom line of black, because change adoption requires fiscal capacity. This must include the impact of time and external costs covering paperwork and audits.

Researchers have been focussed (understandably) on policy implication appearing from central and regional authorities, as well as signals from processing companies. It is the banks, however, that now appear to be having an impact on what farmers can and can't do, including, as interest rates continue to increase, whether a farmer can stay in business.

Farming's Future: Minimising Footprints and Maximising Margins was the conference title for 2010. We might choose to replace the maximum with 'optimum', but the concept remains valid. Now, however, we need to cost in the paperwork and audit time and external cost requirements as part of the research that will (or won't) persuade the farmer that change is possible. We also need to consider the risk involved.

In an EU study (Williams et al. 2023) the researchers found limited evidence of transformational change and commented that the banks, investors and migrant workers (availability of labour) had not received the required attention. If we want change, the economics and the people involved should never be forgotten. Incremental change appears to be the new thinking in Wellington, perhaps recognising the complex interplay between affordability, ability to change behaviour, effectiveness of any changes and unintended consequences. Looking back at the FLRC conferences, most of the work has been about enabling farmers in one way or another within this complexity. Keeping them in the Black so that they can afford to be Green – the theme for 2025?

From scientists to farmers

Technology transfer has frustrations on both sides.

A common observation from scientists (and producers and marketers) is that the speed of change in land-based farm systems and the uptake of scientific advances is slow, in some cases "in excess of fifteen years" (Davies et al. 2018).

The reasons are clear to the farmer: the rhythm of farming, the risk in early adoption (personal brand failure and change in regulations), and the fundamental cost in dollars and system change. Often, the outcomes of the research cannot be easily adopted fully into a commercial farm system. Further development and adaptation of the scientific principles are required, and with which the farmer often requires assistance.

The rhythm of farming is more than the cycle of seasons. On a dairy farm the results of a change in feeding for the herd can be seen at the next emptying of the vat, but the results of a decision to use a bull on some of the dairy herd this year will not be seen for another three when, if the calf is female, she might come into the herd. Only then will she start milking and showing the promised benefits. Or not. Genomic selection has been promoted as a way of increasing genetic gain in a herd (Scott et al. 2021). Chasing one trait can, however, have unintended consequences on others, and inbreeding (with the potential loss of genetic diversity, decreased long-term response to selection, reduced animal performance and ultimately, decreased farm profitability) increases. Early adoption has resulted in some farmers returning to daughter-proven sires because of, for instance, the hairy gene (Halcyon and Matrix; https://www.ruralnewsgroup.co.nz/rural-news/rural-farm-health/lic-stands-by-dna-proven). Similarly, the early movers from battery to colony egg production now find themselves stranded; although compliant with Ministry for Primary Industries regulations, the supermarkets have decided not to purchase their eggs. In environmental matters, early adopters have invested time and money in a change only to find that within a few years they are non-compliant. This has occurred with effluent disposal systems in the Waikato with ongoing arguments about size of ponds and use of bladders. In Otago, some producers are facing a fourth effluent system replacement since 1995 to remain compliant. Uncertainty with regard to future regulation as well as confusion about current regulation was identified in a survey by Macdonald et al. (2015) as a major concern. A second theme established in survey comments was the high financial cost of compliance with little tangible financial reward to the business. In the five years from 2010, Waikato dairy farmers invested on average almost $140,000 to achieve environmental compliance as a result of regulation imposed by the Waikato Regional Council or their dairy company. Most of the survey respondents indicated the capital cost imposed on the business was high with regard to existing capital commitments and annual cash flow; returns to the business were not apparent (Macdonald et al. 2015).

On the other side of the equation, farmers think scientists take a long time to produce a recommendation (Crofoot 2010). The reason for the length of time is that scientists want a high degree of confidence in their results and try to gather data for several seasons. This means that there is a delay between investment in research and the release of results. A typical time pattern of development, adoption, and eventual obsolescence of agricultural technology has been described (Fuglie and Heisey 2007) as seven years to research and develop (and investment in fine tuning then

continues) before uptake starts occurring with early adopters. Costs are still incurred in extension efforts, and benefits grow as more farmers adopt the technology and reap higher yields or lower production costs. Full adoption might take another eight years before benefits will be maximised. Eventually the technology will be replaced by something better.

When research is done on farm, farmers are very interested. They want to make decisions based on results - “if they don't have information, then the decision may not be much better than flipping a coin with a 50% chance for success. So they will be very keen for any information that will improve the odds of success” (Crofoot 2010).

In summary: scientists want to see the results of their research on farm making a difference; farmers want quick results from science investment. The intermediate step of plot and farmlet trials has not always been successful in terms of translation to farm. The recent example of the Forage Value Index makes the point (https://www.dairynz.co.nz/research/science-projects/forage-value-index/): “The Forage Value Index (FVI) was designed to help dairy farmers in New Zealand identify the best forages for their farm system by ranking different ryegrass cultivars. The FVI validation trial was established in the Waikato to evaluate the FVI at farmlet scale. The expectation was that higher FVI pastures would produce more dry matter, leading to increased milk production and profit, and lower production costs. Results from the FVI validation trial showed that the economic advantage expected from the higher FVI cultivars selected from ryegrass DM yield measured at the plot scale, was not captured in this single farmlet scale trial.”
This means that achieving change is not simple – unless you can show the farmer the impact on farm and the costs early on in the process.

Encouraging adoption
New Zealand’s record of uptake in some areas has been extremely rapid. The deer industry, the dairy boom, the expansion of blueberries… all are examples, as is the use of nitrogen in seed crops in the 1990s. In these cases, the income generated from adopting new practices and systems was the key. Other examples of change include the uptake of Kiwigreen, adherence to the 190 kg/ha N cap and the phasing out of battery caged egg production. The first was mandated by the kiwifruit marketer Zespri in order to gain access to lucrative markets (Kilgour et al. 2007); the second and third were enforced through government regulation.

In cases such as Kiwigreen the adoption gave access to Europe, and the income returned to kiwifruit growers via Zespri. Government regulations, however, are generally in response to local society and its wishes. Greenhouse gas discussions are about global issues and trade deals but are not yet part of legislation on farm – though emissions are being measured or modelled and some processors are discussing rewards. This opens the debate on whether incentives or taxes are best for encouraging change – but for processors dealing in what is termed a commodity market, if very difficult to obtain a premium and then to sheet it home to the individual producer (particularly if milk is involved) who ‘did the right thing’. This is becoming apparent with the move to regenerative agriculture, encouraged by the government, and achieving the outcome predicted by some scientists rather than the promises from marketers (Rowarth et al. 2023).

A telling point in the imposition of regulations is that multifactor productivity gains (output per unit of input) in agriculture, (https://www.stats.govt.nz/information-releases/productivity-statistics-1978-2022/) which had been almost double what had been achieved in the EU https://globalagriculturalproductivity.org/2022-gap-report/), stalled in the year to March 2022. Multifactor productivity for agriculture, forestry and fishing was negative 2.1%; labour productivity was negative 4.3%. Regulation inhibits innovation – classical economic theory holds that regulation imposes a cost burden on firms, causing them to reallocate their spending away from investment in innovation (Stewart 2010).

Mandates and regulation assist change. There might be direct monetary benefits, as in Kiwigreen, or there might be no money if regulation means that the farmer is no longer allowed to be in business. Despite the uncertainty regarding the cost versus benefit of compliance investment, the high capital costs were adequately placed into perspective by a survey respondent with the remark *"the costs to our business will be greater if we do not do anything"* (Macdonald et al. 2015). However, the cost of compliance in reducing productivity gains for the country have been shown to be considerable, not the least in farmer morale as the farming business is now more fiscally fragile.

The global environment

The extra challenge for New Zealand in its trading environment is the fact that farmers in other countries are subsidised to assist survival.

Producer Support Estimates have increased since Covid19: "Total support to agriculture reached record levels of USD 851 billion per year during 2020-22 for the 54 countries covered by a new OECD report, as governments sought to shield consumers and producers from global crises and high inflation" (https://www.oecd.org/fr/presse/reforms-needed-to-production-and-market-distorting-policies-as-agricultural-support-reaches-record-highs.htm). This support is nearly a 2.5-fold increase in comparison with two decades ago and is dominated by a few large producing economies. China, India, the United States and the European Union account for 36%, 15%, 14% and 13% of total support provided, respectively. The OECD report stated that just under half of this government support was in the form of measures with the greatest potential for market distortions, such as border tariffs and subsidy payments based on output.

Despite the support, many farmers are struggling and media reports https://www.bbc.com/news/world-europe-68095097?at_campaign_type=owned&at_medium=emails&at_objective=awareness&at_ptr_type=email&at_ptr_name=salesforce&at_campaign=newsbriefingpm&at_email_send_date=20240129&at_send_id=4034221&at_link_title=_Name-Why+Europes+farmers+are+taking+their+anger+to+the+streets_Topic-Politics_Placement-Questions+Answered_Location-btn&at_bbc_team=crm covering most countries (it seems) in Europe, and also Northern Ireland (https://www.agriland.ie/farming-news/agricultural-tyres-to-be-included-in-environmental-scheme/), Wales (https://www.fwi.co.uk/news/angry-welsh-farmers-stage-go-slow-tractor-protest) and the UK (https://news.sky.com/story/farmers-say-industry-on-its-knees-as-they-call-for-supermarkets-to-be-fairer-when-buying-produce-13038688) are citing government regulation and supermarket prices causing farmers to question survival.

The situation is similar in New Zealand where debt is increasing and more debt is being moved on to 'Interest only' (https://businessdesk.co.nz/article/finance/bnz-appoints-receivers-to-farming-operation-after-farm-debt-mediation-breach). On farm inflation has been greater than general CPI (https://beeflambnz.com/sites/default/files/2023-06/Sheep-Beef-On-Farm-Inflation-23.pdf) and prices paid to farmers have not been covering the cost of production (https://www.interest.co.nz/rural-news/124947/some-farmers-will-struggle-cover-costs-season-and-could-pose-risk-financial; https://www.farmersweekly.co.nz/news/hill-farming-looks-at-deficit-budget-ahead/).

In the UK, The Oxford Farming Report 2024 suggested that "instead of a "cheap food" policy at any cost, if future governments chose to champion UK grown food for home consumption and for export, appropriate policy would be developed and implemented". The question should then be asked – what does 'appropriate policy' mean? The report also stated that "increasingly, farmers are leaving the sector and using the land for non-agricultural uses because they simply cannot afford to continue subsidising the cheap food that the UK consumer has been used to".

Farmers charging consumers more for the food they eat would be a considerable challenge, particularly when processors (meat and dairy companies, for instance), customers (Nestlé, Danone, Unilever, MacDonalds) and supermarkets (New Zealand and overseas) are involved in the chain between farmers and consumers. In 2023 the importance of 'price' in food purchase decision making increased from 80 to 87% as did that of taste (68 to 76%), healthfulness (60 to 62%) and convenience (56 to 61%), whereas that of environmental sustainability decreased from 39 to 34% (IFIC 2023).

In summary: food costs more to produce than processors supplying customers and customers supplying consumers are prepared to pay. Although some governments are supporting (subsidising) their farmers to stay in business, pressures are being felt globally. New Zealand farmers do not receive direct government support and are being regulated to change the way they farm (e.g. N caps) with no promise of incomes being maintained or their operations surviving.

The science we do

The struggle for survival puts the onus even more heavily on scientists to do research that will make a positive financial impact on farm. The problem in a budget-constrained science world is that field research is expensive, takes time and can be uncertain. Surveys and reviews are the opposite. Developing models from already collected data in the hope that they can be appropriate in other situations is tempting, but all models are subject to constraints and assumptions. A recent admission in Britain makes the point. The Climate Change Committee's CEO has conceded that 2019 advice to ministers had assumed that in 2050 there would be only 7 days on which wind turbines would produce less than 10% of their potential electricity output. The projection was based on only one year of data – the assumption being that it was a typical year. The reality was 30 days in 2020, 33 in 2019 and 56 in 2018 (according to an analysis by campaign group Net Zero Watch). Emeritus Professor Sir Chris Llewellyn Smith, former director of energy research at Oxford University, and author of a report for the Royal Society, published in September, concluded that a vast network of hydrogen-filled caves was needed to guard against the risk of blackouts under the shift to wind and solar generation, which the Royal Society described as "volatile" because it depends on wind and sun to produce energy

https://www.msn.com/en-us/news/technology/climate-chiefs-admitted-net-zero-plan-based-on-insufficient-data-leading-physicist-says/ar-BB1h05eJ

For farmers the problem is that surveys and reviews are not generally designed for on-farm impact. And models are limited. After two days at the New Zealand Grassland Association conference late in 2023, a farmer delegate stated that the papers and field days were very interesting, but he hadn't yet heard anything that he could implement on farm to make a difference.

Much has been written on the diffusion of innovation, originating with EM Rogers in 1962 (https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/behavioralchangetheories4.html). In summary there are five main points (https://twut.nd.edu/PDF/Summary_Diffusion_Theory.pdf):

1. relative advantage,
2. compatibility with existing values and practices,
3. simplicity and ease of use,
4. trialability, and
5. observable results.

Within the first factor, personal control, time saving and self-esteem carry most weight (Robinson 2009), but economic factors, convenience, prestige and satisfaction are also important.

Compatibility reduces inertia in adoption – incompatibility means that adoption is unlikely until the relative advantages increase. This is exemplified in the "rock bottom moment for change", discussed in an agricultural context by Lissaman et al. (2013).

Simplicity and ease of use reduces the need for assistance in adoption, and result in rapid uptake of a technology. Trialability and observable results reduce apparent risk and increase confidence in adoption.

The levy bodies have been active in reducing risk to change, running field days and conferences as part of their extension programmes, but the economics are not always apparent. On farm, pastoral-based research (Crofoot 2010, 2011) meets the five factors required for innovation diffusion. Better than farmlet trials, it lets the research occur within a real system. It also aligns with results from the 2024 Edelman Trust Report (subtitled Innovation in Peril) that indicates 'someone like me' and 'scientists' are most trusted (74%), whereas only 47% people trust journalists and only 45% trust government leaders https://www.edelman.com/sites/g/files/aatuss191/files/2024-01/2024%20Edelman%20Trust%20Barometer%20Global%20Report_FINAL_1.pdf.

In summary – we have the knowledge but are taking short cuts in the approach and it is the farmers that are being shortchanged.

Conclusions

This paper is not a review of past research, nor a survey of what people think or do. Nor is it a model of any sort. It is an integration of material from different perspectives leading to a call for a change of thinking and a request that, next time you apply for any of the limited funds for research available, you make it clear to the funders that unless the benefits of a change can be quantified in research that considers the five factors, change will be difficult to achieve. Although regulation might force a

particular action, the unintended consequence might mean farmers leaving the industry, as they are in the UK.

It is also a call to the organisers of the next FLRC workshop – farmed landscapes must be in the black to keep them green.

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