

New Zealand agriculture is suffering from a crisis of confidence. It no longer has a social licence to do as it pleases. The 'rules of the game' have changed and will continue to do so. The challenge for New Zealand agriculture is how to adapt to those new rules while remaining vibrant and profitable. The challenge is particularly severe for dairying, which is this country's most important agricultural industry.

It was way back in 1963 that Bob Dylan wrote the song 'The times they are a-changing'. So surely there is nothing new about change – we hear about it all the time. But for New Zealand agriculture, and dairying in particular, something is currently occurring that goes beyond normal change; it is the fundamental rules of the game that are changing.

The New Zealand agricultural industry became accustomed during the first 15 years of this century to

an economic environment where product prices were volatile but generally increasing. After being labelled in the late 1990s by then Prime Minister Lange and others as a 'sunset industry', New Zealand agriculture rose again. Agriculture has been contributing more and more to New Zealand's export income despite much of the so-called 'smart thinking' within urban New Zealand still being that agriculture is more about New Zealand's past than its future.

Urban attitude

New Zealand agriculture has also become accustomed to living with an urban community that is increasingly divorced from an understanding of what farmers do and why. That has been an ongoing process for more than 50 years. However, it is not only the urban perspectives that have been changing; so too has the nature of farming itself. The image of the outdoor bloke and the family farm, which the industry itself still loves to portray in its TV advertising, no longer matches the apparent reality (as

perceived by urban folk) of large-scale capital-intensive industrial farming. Consequently, the urban community has changed from being poorly informed and ambivalent about agriculture to still being poorly informed but increasingly hostile.

How did all of this happen? Where is it leading? What can be done about it? And in the broader New Zealand context, does it really matter?

The importance of exports

Yes, it does all matter to New Zealand. This is because New Zealand has an export-led economy. Exports comprise about 28% of the New Zealand economy (World Bank data as at 2014), down from 36% back in 2000. In the short and even the medium term the economy can manage this decline through trade deficits and balancing capital inflows, but in the long term, if exports go down, then the rest of the economy also has to adjust. So, if New Zealand agriculture were to fall into decline, then other

Particularly in the last 10 years, New Zealand agriculture has become accustomed to increasing but manageable environmental regulations. Pastoral farmers have invested in fencing of waterways, dairy farmers have invested in effluent management systems, and both crop and dairy farmers have invested in more efficient irrigation systems. They were able to do this without change to their fundamental farming systems.

KEITH WOODFORD was Professor of Farm Management and Agribusiness at Lincoln University from 2000 to 2014, having worked away from New Zealand for the preceding 19 years. He now holds an honorary position at Lincoln as Professor of Agri-Food Systems, and consults on agri-food systems projects in New Zealand and internationally. Email: kbwoodford@gmail.com

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Changing rural attitudes

One thing for sure is that mainstream urban thinking will impact on the social licence that agriculture has to operate under. Accordingly, a key issue is how the agricultural industry will respond to the new environmental rules that society will impose.

Within the agricultural community, I sense a strong perspective that somehow it is only urban attitudes that have to change. That is important, and some of us are working away at that. The way to do it is to stick to the issues and never take on the protagonists in a way that is personal. But that will not be enough.

The agricultural industry also has to recognise that it too has to change its attitudes. That includes not defending the indefensible. It also includes shedding bully-boy actions such as those recently undertaken by major agricultural companies who have put their urban service suppliers onto payment terms of up to 91 days. It also includes thinking again about PR-led communications that are widely considered by the urban folk to be nothing more than self-interested propaganda coming from rural elites. If it is always 'other people' who have to change their attitudes, then we will not get far.

The pastoral challenge

Clearly, it is pastoral agriculture and dairying in particular that is currently 'in the gun'. In contrast, I expect that kiwifruit will continue to prosper as the agronomic boundaries extend out more widely from the Bay of Plenty. Wine also has opportunities, although locations outside Marlborough will be increasingly needed. There are also opportunities for apples, underpinned by ongoing development of new protected plant varieties. I also have hopes for a greatly expanded mussel industry from offshore (not in-shore) locations.

The particular challenge for pastoral agriculture is that the current farming systems are shaped by history. The industries have grown up in an environment where it was implicitly assumed that the environment could carry the wastes. Farmers thought they could do things by right which they can no longer do, and that creates anger. An associated issue is that farmers are learning that freehold title is actually a restricted licence in regard to land use, increasingly constrained by the need to meet nitrogen leaching limits, phosphorus run-off limits and, in some cases, changing water use rights. Although dairying has been the first to feel these new constraints, they are now increasingly affecting other pastoral farmers.

A key problem is the dairy cow of which there are more than five million. Our dairy systems are based on high protein pastures, and this exacerbates the nitrogen

problem in the cow urine. There is an irony in that when urban people think of 'dirty dairying' they think of intensive systems, but do not recognise that it is our nitrogen-fed ryegrass pastures plus nitrogen-fed winter fodder crops that are the fundamental source of nitrogen leaching, albeit via concentrated cow urine.

Part of the solution lies in more use of high-energy low-protein crops, both to balance the cow diet and also to mop up excess excreted nitrogen in the soil. Aligned to this, and even more important, is that dairy cows need to spend late autumn and winter resting off-paddock where effluent can be collected, then stored and taken back to the land in spring. These suggested solutions, although mainstream in the rest of the developed world, inevitably bring forth hostility from the local dairy industry. It is a social issue and we are seeing a social response. It is a normal behaviour in times of change when traditional industries are going through a stage of denial. All sorts of reasons are brought forward, both practical and economic, as to why it cannot happen. My response is that is all okay as long as the industry does not mind going into decline.

Reshaping of the dairy industry

For the last four years, I have been pondering as to how our future dairy industry might look. Given the freedom that goes with being a former academic, now an independent consultant in the so-called later years of life, I have been seeking out (and have been sought out by) those who have decided to step forward on the journey of exploration. I seek to learn from those farmers who are looking over the horizons to the new promised land, and sharing in that process, with all its ups and downs.

The big picture of that future dairy industry is of a unique New Zealand hybrid system, where cows are housed indoors during winter with matting or similar beds for lying on, and going outdoors for up to six hours per day for grazing. The dominant feed over the 12-month period will still be pasture, but supplemented by a range of crops, which in at least some cases can be grown on-farm as 'nitrogen soaks'. Nutrients will be closely monitored across the system (plant, animal and soil). Milk will be produced 12 months of the year and cows will calve evenly throughout the year. Effluent will be stored over winter and may also be removed from the system via methane digesters (currently being trialled in New Zealand on-farm) and also through the transference of effluent nutrients in solid form to other farms as fertiliser.

With this new system, the cows will lactate for about 320 days on average (compared to 260 currently) followed by a 45-day dry period. They will produce at least 1.1 kg of milksolids per annum for every kg of cow liveweight and

Pivot irrigation and in-ground soil-moisture metering are fundamental to water use efficiency and reducing nitrogen leaching for future farming. Both water use and leaching can be halved relative to old-style surface irrigation

export industries would need to step up or else the whole economy would go into decline. And what would those new export industries be?

It certainly won't be a car assembly industry and it is highly unlikely to be a mineral-led industry that will carry New Zealand forward. That is not where our comparative advantage lies. It is also not likely to be a major digital technology industry. There are plenty of digital niche opportunities 'out there' waiting to be captured, but for anything mainstream, the evidence, once again, is that we lack comparative advantage. Successful mainstream digital industries inevitably migrate to the bigger countries. So, if it is not going to be our primary industries, then it will have to be tourism and international education that step up. They are and can be great earners, but they also bring their own problems. Both are 'fair weather' volatile industries.

The traditional way of measuring industry contribution, beyond GDP and exports, has been to look at the multipliers from what are called input-output analyses. For example, back in 2009, and using this approach, the NZIER calculated that for every additional dollar of income earned directly by the New Zealand wine industry, there was an additional \$1.76 earned elsewhere in the economy (NZIER, 2009). Similarly, for each job created within the industry itself, there were an additional 1.79 full-time equivalent jobs created elsewhere.

More recently, there has been a shift within the economics profession to move away from simple input-output models to more complex CGE (computable general equilibrium) models. In line with this, in 2010 the NZIER

undertook a CGE analysis of New Zealand dairying for Fonterra and DairyNZ (NZIER, 2010) and a further study was undertaken in 2016 for DCANZ (NZIER, 2017). The results do not make great headline reading. There are no longer any simple multipliers that an extra dollar of export income will produce several times that amount throughout the economy, or that for every job created within the industry there will be several additional jobs created elsewhere. Instead, there are general statements, apparently shaped for the clients, that dairy is big and important to the economy. However, the associated numbers are complex, much smaller than previously, and not well-suited for headlines. Accordingly, an urban New Zealander might well interpret this report as showing that New Zealand could manage without dairy.

I learned a long time ago that within complex models there can be major shaping assumptions that are invisible to those who do not understand the calculus. Models are therefore great for bringing structure to what would otherwise be an unstructured mess, but the outputs are only as good as those hidden assumptions. In relation to dairying, the inherent assumptions within the NZIER dairy reports include that the resources can be successfully reallocated elsewhere.

My own interpretations are that in the absence of a buoyant agriculture industry, New Zealand does indeed face tough times ahead with negative impacts that will flow strongly throughout the economy. However, I do not expect those views to be mainstream within the urban community.

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this ratio will be a key performance indicator (KPI). The better farms will produce more than 1.2 kg of milksolids per kg liveweight. Within this system, and when properly fed, the cows will be happy to milk for a little longer in return for not being quite so rushed to get back into calf.

The key constraint for this new system is the additional infrastructure capital of \$6 to \$10 for every kg of milksolids. However, the overall capital investment per kg of milksolids can be less for these systems than for our current pastoral systems, because overall capital is spread across more production. With this system, a greater proportion of feed goes into production rather than animal maintenance, with associated reduction in greenhouse gases per kg of milksolids.

I am monitoring a number of farmers who have been implementing these systems, and with modest winter milk premiums, and in some cases even without these premiums, the economics are sound. This is irrespective of value being placed on the environmental benefits. However, the biggest constraint is sometimes the farmer; if a barn is built without fundamental rejigging of the farming system, then the economics are indeed doubtful, and environmental benefits may also not be achieved.

Beef and sheep farming will also change

The pastoral journey in New Zealand will need to involve rethinking that goes well beyond dairy. In particular, if dairy shifts away from seasonal calving, then profound opportunities arise to make use of all the surplus calves born to dairy cows. It may initially seem surprising, but the key issue for beef is sex-selected semen within the dairy industry. This technology already works well overseas in association with 12-month dairy systems. However, it does not work well in New Zealand with seasonal calving, where even a very minor reduction in conception rates places an unacceptable additional stress on the overall system. Of course, there will be challenges, with a need to focus on beef sires that produce small beef calves, but this is all very manageable once we shed the notion that big is always best. In terms of system energetics, being big is not a key requirement. Nutrient management within beef farming will become an increasing issue.

Our sheep industry will also continue to evolve, and may get even smaller as it becomes increasingly squeezed by environmental forestry and beef. A lot will depend on market positioning. In our family, we are doing our bit to help the industry by wearing more than our share of wool clothing and also having a partiality for lamb meat, but we do not represent the mainstream. The key markets are the Muslim countries, including more than 25 million Muslim Chinese.

Whole-of-system innovation

In this article, I have focused on production-related issues, but paradigm shifts are also required in relation to whole-of-chain food systems. We don't like foreign investment but we ourselves do not invest sufficiently beyond the farm gate. We talk a lot about 'value-adding' as if it were easy and a 'no-brainer', but then don't embrace the key concepts associated with having a 'consumer focus'. Our words and our actions do not align. There is also a lingering perception that because a commodity focus associated with low-cost production has served us well in the past, that low-cost commodities can still be the mainstream path going forward. I call that the 'shrivel plan'.

If our agricultural industry is to prosper in the new emerging world, then it is going to require strong leadership, including much more forward-looking 'innovation systems' (the new term that encompasses but also goes beyond traditional R&D systems). Strong leaders do not seek popularity; rather, they lead boldly from a forward-thinking perspective, based on evidence-based positions as to the opportunities and the constraints that need to be addressed. By definition, they attract criticism. Currently, I see insufficient leadership and too much thinking that is grounded in the defence of traditional paradigms, and which nibbles away at the edges of the problems. I see almost no formal R&D leading towards the paths I have suggested here. Much of it is populist stuff that meets the self-interested short-term objectives of the research institutions. It is time for a lot more new thinking.

NZIER reports

NZIER 2009. *Economic impact of the New Zealand wine industry.* A report to New Zealand Winegrowers.

Available at <https://nzier.org.nz/publication>.

NZIER 2010. *Dairy's role in sustaining New Zealand.*

A report to Fonterra and DairyNZ.

Available at <https://nzier.org.nz/publication>.

NZIER 2017. *Dairy trade's economic contribution to New Zealand.* A report prepared for DCANZ.

Available at <https://nzier.org.nz/publication>. 

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