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Sustainable productivity in an economic world

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If we're talking about agriculture in 2050, the starting point isn't technology or policy. It's economics.

Farming has always been shaped by margins. When a machine costs more than a million dollars, small operational details suddenly matter a great deal. The length of a paddock run, how often a tractor has to turn, how much fuel it burns over a season – these are not minor considerations. Over hundreds of hectares and multiple passes a year, those differences accumulate. That steady focus on efficiency has gradually reshaped farm layouts, particularly in places like Western Australia, where scale has become central to staying competitive.

The same financial logic explains why land use shifts when conditions change. After a string of good seasons, many pasture producers in Western Australia have moved into cropping. More than a million extra hectares of wheat went in last year, along with a significant lift in canola, simply because the returns made sense. After seven or eight favourable seasons in a row, cropping can begin to feel like a low-risk decision. It rarely stays that way forever, but in the moment, the numbers drive behaviour.

Income diversification follows the same pattern. A wind turbine on a property may not appeal to everyone aesthetically, but the annual payment provides stability. In a business where income can swing widely with weather and markets, that matters.

Water allocation tells a similar story. Permanent plantings such as almonds represent years of sunk capital. Losing trees is not the same as losing an annual crop. That reality shapes policy and priority. These pressures aren't abstract. They reflect how agricultural investment works in practice.

Land values bring another layer of complexity. In many regions, purchase prices imply returns that are tight by historical standards. For younger farmers buying in at those levels, the margin for error narrows. Recent La Niña seasons have supported strong yields and reinforced confidence. But climate systems move in cycles. When they shift, businesses carrying high debt and high land values will feel it quickly.

In the end, economics defines the space in which every other decision is made.

> **"New Zealand cannot compete globally on volume alone. We compete on quality."**

Technology works when it fits

Agriculture has seen a rush of investment in new technologies, much of it aimed directly at farmers. The assumption is often that growers are a large consumer market. In reality, particularly in countries like Australia and New Zealand, the number of farmers is relatively small and they are already managing complex operations. They are cautious about tools that sit outside their existing systems or demand extra time.

Technology tends to gain traction when it fits into what is already there. Fertiliser suppliers can incorporate data analytics into their recommendations. Seed companies can combine yield records, satellite imagery and crop models to refine planting advice. When those insights arrive as part of normal business interactions, uptake is far more likely.

Plant breeding provides a clear example. Genomic marker technologies were once seen as an added expense. Over time, they became embedded in breeding programme and are now routine. Hybrid seeds in horticulture carry years of accumulated research. A tomato seed worth a dollar reflects the reliability and performance built into it through long-term scientific work. That value has been absorbed into commercial systems rather than sitting alongside them as an optional extra.

Remote sensing is moving in the same direction. Drones are already used to measure canopy temperature and detect nutrient stress at fine resolution. Hyperspectral satellites are expanding those capabilities across whole regions, capturing detailed light signatures that indicate plant health and biomass. Subtle differences in canopy colour or temperature can signal nutrient deficiencies before yield losses become visible. As land becomes more expensive, managing variability within paddocks at a finer scale becomes worthwhile. Measurement tools are gradually shifting from research into everyday management.

Market access is another area where integration matters. Australia and New Zealand cannot compete globally on volume alone. We compete on quality. Traceability systems such as fibre identification in cotton allow producers to verify origin and production standards through processing. These systems cost money, but they support access to premium markets where transparency influences purchasing decisions.

Managing land for the long term

Looking after land over decades comes back to basics: soil and water.

It's easy to focus on what a crop returns in a single season. What's less obvious is what it quietly takes away. Every harvest removes nutrients. The major ones like nitrogen, phosphorus and potassium are routinely replaced. The smaller elements don't get the same attention. Zinc, manganese and others can decline slowly over time, and the signs aren't dramatic at first. A slight change in colour. A patch that grows a little shorter. It can take careful measurement to notice the pattern before it shows up in yield.

That's where newer tools are starting to matter. Precision application systems allow inputs to be adjusted across a paddock rather than applied uniformly. Satellite imagery and drones add another layer, helping growers see variation they might otherwise miss. When land values are high, ignoring those differences becomes costly. Paying attention to small variations is not about perfection. It's about protecting a long-term asset.

Climate makes this more pressing. A run of good seasons can give a sense of stability. In Western Australia, strong rainfall patterns have encouraged expansion into cropping. That's understandable. But seasons change. When rainfall tightens again, soil condition and past management decisions will determine how well a system holds up.

Horticulture is dealing with similar realities. In Queensland, growers are putting up shade structures and adjustable roofing to cope with heat stress. In South Australia, large glasshouses recycle most of their water because they have to. These systems aren't cheap, but they reflect the direction things are heading as temperatures rise and water becomes less predictable.

Elsewhere, the same principle plays out at a different scale. A farmer in India or Africa working a few hectares faces decisions that can affect a family's income for the year. Whether to apply fertiliser. Whether to transport produce to market. Access to reliable price forecasts or satellite-based advice can shift those decisions in meaningful ways. Across millions of small farms, those marginal gains add up.

People make the system work

All of this depends on people. Across our region, there are significantly more agricultural jobs than graduates – often 10 roles for every one person coming through. At the same time, much of the advanced training in analytics and artificial intelligence is undertaken by overseas students who may not stay. Many growers are also nearing retirement, so that combination creates pressure on capability.

Artificial intelligence can help analyse patterns across climate, soils and crop performance. It can support better decisions, especially where large datasets are involved. But it doesn't replace experience. The quality of the outcome depends on the people asking the questions and interpreting the results.

By 2050, agriculture in Australia and New Zealand will likely be more data-informed, more diversified in income and more accountable to global markets demanding transparency. Climate variability will still shape production, and land prices will continue to influence strategy.

The constant, though, will be the need to balance economics with stewardship. Soil and water still sit at the centre. Technology will only matter if it strengthens those foundations and fits within how farms actually operate. And the system will only function as well as the people working within it.

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