



Establishing a minimum record of account at the farm level: productive capacity and risk-adjusted opportunity through a digital adoption lens

Chris Geeves, The Lightwood Consultancy.
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chris@lightwoodconsultancy.com



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Executive summary

Producers and agronomists make input decisions using evidence scattered across soil tests, yield maps, agronomy advice, invoices and seasonal results. That evidence is rarely linked to what was decided or what happened next. A season's result cannot, on its own, distinguish a good decision from a favourable season or a drawdown of the soil's capacity to produce.

This paper argues four points:

1. Soil sets the ceiling on what inputs can achieve. Its productive capacity determines what range of production a paddock can support and under what conditions. Where a soil constraint blocks the response, withholding spending can be the better decision.
2. A single season's result can conceal the true cost of a decision. Costs shift between seasons; decisions that cut spending now may narrow future options. Yield-gap research suggests that producers capture less of the upside in favourable seasons, with nitrogen under-application a significant factor ^{[4][6][7]}. As variability increases, capturing more in good seasons to carry the cost of poor ones becomes a larger part of farm profitability. A decision should be judged on expected return, risk and its effect on the paddock's future productive capacity, not on one season's margin.
3. This requires a shift in how farm decisions are planned and judged. The underlying goal is inter-generational: a farm that can keep producing profitably across many seasons, not the current one alone. Decisions made from memory and disconnected records cannot improve systematically, and mistakes compound without being recognised as patterns. Some farming systems, continuing on their current trajectory, may face a narrowing window of productive and financial viability. This paper draws that inference from declining cool-season rainfall, estimated profit impacts from drier conditions and soil constraints that compound when unaddressed, rather than from direct measurement of any system's trajectory.
4. A minimum record of account (MRA) makes decisions reviewable by connecting what was known, recommended, decided, done and measured. The MRA does not determine what a producer decides; it strengthens the basis on which decisions are made and the ability to learn from results across seasons. Digital integration is what makes an MRA feasible. Adoption depends on keeping the record small, the data reliable, the rules for data use explicit and the benefit to the producer visible. Agronomists are the critical path for establishing the practice.

Whether an MRA changes decisions or improves returns is untested. This paper sets out the case; the necessary next step is to test it.

Introduction

The evidence base for farm-level input decisions is fragmented. Soil tests, crop records, machinery data, agronomic recommendations, invoices and yield results each sit in separate systems. Without linking them together: a yield result says little about why a paddock performed as it did; an input record tells the producer what was spent, not whether the spending was justified; a soil test identifies conditions but does not show how they affected production or which response will pay.

An MRA sits across these records and links them to the decisions made and the results achieved. It holds an account of productive capacity, management actions, costs and outcomes over time, so producers and agronomists can identify constraints, assess likely input responses, compare options and check whether earlier decisions delivered what was expected.

The paper focuses on broadacre cropping in the Australian grain belt. The MRA described here is a proposed framework; no pilot or case study yet provides evidence of its effect on farm decisions or returns.

The paper proceeds in five parts:

1. soil as a production asset and how inputs interact with capacity;
2. seasonal and spatial evidence for why current decision-making systematically under-captures value;
3. frameworks for assessing decisions before and after the result, extended to an inter-generational horizon;
4. the minimum record of account, what digital integration makes practical and what adoption requires;
5. and what the MRA means for the agronomy business itself.

Part 1. Soil, productive capacity and inputs

Soil as a production asset

Soil is one of agriculture's most important production assets. Its ability to capture and store water, support healthy root development and supply nutrients underpins the earning capacity of a farming enterprise.

Soil constraints carry a measurable cost. A national modelling study of Australian wheat estimated annual lost production of about \$1.3 billion from sodicity, \$400 million from acidity and \$200 million from salinity ^[1].

Different soils serve different roles and support different ranges of production. A heavy cropping soil, a sandy wheat paddock and a pasture carrying breeding ewes will vary in water-holding characteristics, rooting conditions and nutrient supply. They cannot be held to the same production expectation. Setting a realistic target for any paddock requires evidence about soil structure, rooting depth, plant-available water capacity (PAWC), nutrient availability, salinity and sodicity, among other factors.

Productive capacity and inputs

Productive capacity describes the overall ability of a paddock or farming system to produce profitable agricultural outputs within the limits of its soil, water, climate and management conditions, while maintaining its ability to perform into the future.

Soil health helps establish productive capacity, while crop nutrition and other management inputs influence how much of that capacity can be converted into production during a particular season.

Fertilisers, crop-protection products and other interventions remain important tools for maintaining production and responding to seasonal opportunities, though their value depends on the conditions of application. Extra nitrogen pays where the crop is nitrogen-limited and enough water and growing time remain. It returns little where rooting depth, PAWC or crop stage caps the crop's ability to use the nutrient.

The task facing producers and agronomists is broad. They need to understand what limits performance, how those limits interact with management and season, and whether this season's decisions affect the paddock's ability to keep performing into the future.

A nutrition plan set before sowing may need revision as conditions shift. An additional application can protect yield or capture a favourable season; in other conditions, withholding it is the better economic decision. Additionally, investing now in nutrient supply plasticity - a soil's own capacity to keep supplying nutrients as conditions change - helps to maximise productive capacity as well as buffer a farm against input and commodity price swings. High plasticity gives management scope to draw on the soil's reserves when urea is expensive or grain prices weak, and to lift nutrient inputs when the season justifies it.

Research illustrates the broader potential of matching inputs to soil capacity. CSIRO's National Water-use Efficiency Initiative showed grain-yield increases from 16 to 91% when management was matched to soil and season, with nitrogen supply producing the largest gains ^[3]. Noting these were upper bounds from specific experimental conditions, not expected averages.



Part 2. Seasonal decisions and the yield gap

Part 1 established what soil can and cannot do. This part examines how seasonal decisions interact with those physical limits and where producers systematically leave value on the table.

The yield gap, producer risk aversion and setting up for favourable seasons

National yield-gap research quantifies how much potential goes unused. Australian wheat yields average about half of water-limited yield potential, with the gap tending to be larger in higher-potential regions ^[4]. Average farm yields tend to plateau at 75 to 85% of water-limited yield, so the exploitable gap is measured against about 80% of potential ^[5].

Nitrogen is the largest single factor. The average national rate of 45 kg N/ha left wheat at about 60% of water-limited yield ^[6]. A survey of 250 paddocks over four years found a smaller average gap (~20%), but one that grew with yield potential: producers were less likely to capture the upside of favourable seasons, mainly because crops with the highest potential were most likely to be short of nitrogen ^[7].

The national analysis estimates the gap across all farms and seasons; the paddock survey captures the gap on farms already reporting detailed data, likely skewing toward better-managed operations. What both find is that the gap widens as yield potential rises.

Producer risk aversion is one explanation. Monjardino and colleagues analysed 14 wheatbelt sites and found that risk-averse producers cut inputs further, giving up profit in good seasons to limit losses in poor ones, an effect most pronounced at low-rainfall, more variable sites ^[8]. Separately, simulation at Brinkworth, South Australia, showed the economically optimal nitrogen rate at 100 kg N/ha across 30 seasons but ranging from 140 kg N in above-median rainfall to 40 kg N in below-median ^[9]. Fischer and colleagues noted that farm yields were well below water-limited potential in good seasons, largely from lack of nitrogen, reflecting risk aversion in a dry, variable environment ^[10].

The cost of that caution is asymmetric. Under-applying nitrogen in a favourable season forgoes both yield and profit, while over-applying in a poor season wastes money for little extra yield - and the profit lost in a good year typically exceeds the input wasted in a bad one ^[5].

GRDC's Profitable Yield Frontiers project notes that most yield-defining decisions are made by stem extension in August, while most variation in yield-determining conditions occurs later ^[11]. Field experiments in South Australia and Victoria in 2024 and 2025 show the benefit of setting up for favourable seasons. By adding 30 mm of water at the start of the critical period to simulate a favourable spring, crops with adequate canopy and nitrogen converted it into grain; crops that arrived under stress responded variably and rarely exceeded the yield of well-prepared crops ^[12].

A harder planning environment and how profitable planning needs to change

Setting up to capture favourable seasons is becoming both more important and more difficult. Cool-season rainfall has fallen about 16% in the south-west since 1970 and about 9% in the south-east since 1994 ^[13]. ABARES modelling estimated that the hotter, drier conditions of 2000 to 2019 cut average cropping-farm profit by about 35% compared with 1950 to 1999; without the adaptation producers have made since 1990, the fall would have been 49% ^[14]. Australia's wheat yield



variability is the highest among six countries studied by the OECD (coefficient of variation 0.47 on individual farms), with yield risk more systemic because drought affects all crops at once ^[15].

As variability rises, capturing more in favourable seasons matters more, because a producer who does so can better carry the cost of poor ones. This changes how a profitable paddock decision should be understood. It is the decision that accounts for the paddock's constraints, the probability of capturing upside when conditions allow, and the effect on productive capacity beyond the current crop.

The yield-gap research makes clear that risk aversion is the primary driver of under-application, not a lack of agronomic knowledge. The argument is not that current decisions are wrong but that they are made against evidence that is often incomplete, disconnected and difficult to accumulate across seasons. An MRA does not override a producer's risk judgement. It improves the evidence on which that judgement is made.

How an MRA might do this is worth making explicit. Multi-season records can reveal the actual distribution of outcomes from past decisions: how often the conservative call avoided a real loss, how often it cost more in foregone margin than the loss it prevented, and what the cumulative effect has been on the paddock's productive capacity. Where that evidence shows the downside was smaller or less frequent than assumed, or that the cost of repeated under-investment has compounded, the producer's own assessment of the risk may shift, not because someone told them to change, but because their own record shows something about the pattern that any individual season conceals. This is a hypothesis, not a demonstrated result, and is among the questions a working MRA would need to test.

Spatial variability within paddocks is a key consideration

Whole-paddock averages conceal differences that matter. A composite soil test, an average yield or a single fertiliser rate hides the potential and constraints of individual zones. This is the tyranny of the average.

Multi-year yield maps, soil information and measurements such as apparent electrical conductivity help identify patterns worth investigating. Griffiths' work on northern grey Vertosols used spatially modelled soil water-holding capacity and subsoil constraints to examine their relationship with crop biomass and yield ^[16].

Two economic problems arise when spatial variation is ignored:

The sinkhole effect

The sinkhole effect occurs when inputs are spent in zones where a soil constraint limits the crop's ability to use them. Tilse and colleagues mapped subsoil constraints across about 80,000 hectares of northern New South Wales. At least one constraint occurred across 54% of the area, with modelled effects averaging a reduction of about 50 mm in available water capacity and a potential wheat yield loss of 1.1 t/ha ^[17]. Where constraints are that prevalent, a uniform input strategy inevitably spends in zones where the crop cannot convert those inputs into yield.

The yield ceiling penalty



Inversely, the yield ceiling penalty is production lost when management based on paddock-wide averages leaves higher-potential zones short of nutrition or well-timed inputs.

This part has described three dimensions of the same problem. Yield-gap research shows that producers systematically under-capture value in favourable seasons, mainly through insufficient nitrogen. Climate trends are making those favourable seasons both less frequent and more important to capture. And spatial variability means that even a well-timed decision can misallocate inputs. Each points to the same question: given the evidence for a constraint or an opportunity, how does a producer judge whether acting is worth the cost, the risk, and the time remaining in the season?

Part 3. Assessing profitable decisions over time

The previous part identified where current practice falls short. This part sets out how to assess a decision before and after the season, how costs shift across time, and why the frame for judging success needs to extend beyond any single year.

Risk-adjusted opportunity: planning actions

A risk-adjusted opportunity is a potential gain identified where evidence supports a crop's capacity to respond - the right zone, the right crop stage, enough stored water - weighed against the cost and likelihood of that response failing to materialise. The concept matters because the risks of acting and not acting are not equal.

Assessing the opportunity starts with a specific zone and a specific question: given what we know about this soil's capacity, this crop's stage and the seasonal outlook, what response could a management action realistically deliver, and what does it cost if conditions turn against it?

Taking a risk-adjusted opportunity approach asks: "given the current probabilities, is this bet worth taking?". It seeks to optimise upside capture while limiting downside loss.

The target return and the conditions that would trigger a change of course are set before the decision is made, not assessed after the fact. As the season develops, new information - rainfall, crop condition, updated forecasts - is measured against those pre-set thresholds. The result is a decision process that can pursue upside without defaulting to either habitual caution or unchecked optimism.

A late-season nitrogen application illustrates this. The likely response depends on soil moisture, crop development, the chance of finishing rain, grain price, application cost and the time left for the crop to respond. Connecting the available evidence to a decision deadline gives agronomist and producer a shared basis for action.

Risk-adjusted return: evaluating decisions

Risk-adjusted return should look at what each decision delivered, rather than what the overall season delivered. Raw margin - yield times price minus input cost - does not distinguish between a result driven by a well-matched decision and one carried by a favourable season.

The adjustment asks three questions: what conditions produced this result, would the same decision produce a similar result across a range of seasons, and did the action leave the paddock's productive capacity intact, depleted, or improved? A nitrogen application that returned \$40/ha in a wet year but would lose money in three years out of five has a different risk-adjusted return from one that returns



\$25/ha reliably. Tracking these over time builds a record of which decisions consistently add value and which depend on conditions the producer cannot control.

This approach asks: "did we actually win because of strategy, or just because we got lucky?". It seeks to audit decision quality and build long-term systemic resilience. The process identifies that the backward view trains the forward view.

A decision and review process links the two views in six steps:

1. Identify the constraint or opportunity and the evidence for it.
2. Assess likely response, costs, uncertainty and downside.
3. Decide by comparing options, including withholding spending.
4. Implement and record what was done, where, when, and any departure from the recommendation.
5. Measure the result against expectation, allowing for season and other factors.
6. Review and revise future assumptions, management and investment.

Records that connect original conditions and recommendation to action and outcome make the reasoning reviewable. Ultimately, this process implies a different kind of advisory relationship - one structured around long-term continuity and structural review rather than transactional, seasonal prescriptions.

Cost shifting and reconsidering maximum biological output as a measure of success

Judging a decision on one year's result can misstates its economic effect.

A high-yielding crop can draw down nutrient reserves. Cutting soil-maintenance spending can improve this year's cash flow while leaving a constraint that lowers future production. In both cases the cost has not been avoided - it has been moved. This is cost shifting: the timing of the cost moves while the cost itself remains.

The consequences depend on whether the producer recognises the downstream cost:

- **Acknowledged cost shifting:** A producer who defers lime application to manage cash flow, knowing the soil will acidify further, has acknowledged the future cost and can plan to address it.
- **Unacknowledged cost shifting:** A producer who repeatedly under-applies nitrogen to manage seasonal risk may not recognise that the saving is being drawn from the soil's nutrient reserves - a cost that will surface as lower starting fertility in future seasons.

The distinction matters because acknowledged cost shifting can be revisited and reversed. Unacknowledged cost shifting just gets worse.

The most profitable system often operates below maximum biological output. In mixed farming, the choice between continuing to crop a paddock and returning it to pasture involves trade-offs between crop returns, livestock production, soil condition and later crops. A low-cost season may be drawing down future capacity in ways the current year's margin does not show.

The Victorian long-term trial illustrates the value of building reserves ahead of need. Systems receiving 40 kg N/ha per year accumulated a surplus of about 150 kg N/ha entering the Millennium



Drought and drew it down in the better seasons from 2009^[9]. The cost was carried in advance; the return came when conditions allowed.

Volatility flattening

Volatility flattening is a direct upside of risk-adjusted planning and review. This is more than load-balancing good and bad seasons from a general yield and management perspective. It is about insulating the business from shocks entirely outside of farm control, such as global events, market disruptions, or catastrophes.

Climate, input prices, commodity markets and disease can each turn a sound plan into a loss. These costs are structural features of Australian broadacre farming. Climate and price volatility give Australian farms variation in output and income greater than most farmers in other countries or business owners in other sectors face, and many broadacre businesses hold substantial liquid assets relative to household income to offset it ^[18].

Volatility cannot be removed, but its damage can be reduced. Operating volatility is driven by a structural working capital lag: major input expenditures - such as up-front fertiliser contracts, seed treatments, and pre-emergent chemicals - are locked in up to nine months before harvest logistics allow for grain price discovery or cash execution. Because individual producers cannot control global fertiliser spikes, sudden trade barriers, or macroeconomic market collapses, risk mitigation requires decoupling input risk from fixed yield targets.

Holding large cash reserves is a passive, expensive way to survive a shock. By tying input decisions to verified indicators, rather than historical habit or forward market speculation, the farm minimises its unbacked capital exposure before a shock hits - the multi-year volatility curve is flattened because the business has structurally minimised its unrecoverable variable costs.

An MRA, in the instance of major cash-flow shock, can also prove to lenders that losses were calculated, rather than a structural operational failure.

Inter-generational farm planning

Some farming systems, continuing on their current trajectory, may face a narrowing window of productive and financial viability. This is an inference drawn from declining cool-season rainfall ^[13], estimated profit impacts from drier conditions ^[14], and soil constraints that compound when unaddressed ^[17].

The five-year Victorian experiment shows where extractive strategy breaks down. The most profitable fertiliser strategies held the nitrogen balance neutral to slightly positive; profit fell once the balance moved more than 50 kg N/ha from neutral ^[19].

A successful result, under this paper's frame, is one that leaves the farm able to keep producing: its soil, its finances and its management systems are in a stronger or at least no weaker position.

However, sustainable practice change requires that producers can maintain or rebuild capacity while at the same time meeting the farm's commercial requirements. For the national Australian food supply chain to remain secure over an inter-generational timeline, individual farm businesses must remain profitable in the short term while protecting their underlying biophysical assets.

If a producer has to mine the soil this season to stay solvent, the MRA and the risk-adjusted process doesn't stop them. It changes how they do it, so that the decision isn't fatal to the farm's longevity.



When a farm is forced to mine its biophysical assets to maintain short-term commercial solvency, the MRA treats that choice as a transparent, multi-season debt against the paddock's productive capacity.

How these steps connect in practice:

The six-step decision process can be illustrated through a hypothetical wheat paddock in southern New South Wales entering its third consecutive cereal crop.

Soil testing and multi-year yield maps show two distinct zones. The western zone has a PAWC of around 160 mm with no significant subsoil limitations. The eastern zone, covering roughly 40% of the area, shows elevated sodicity below 40 cm and a PAWC closer to 100 mm. Yield maps from the previous two seasons show the eastern zone consistently underperforming by 0.8 to 1.2 t/ha. The paddock has been on a flat nitrogen rate of 50 kg N/ha.

The agronomist recommends splitting the rate: 100 kg N/ha in the western zone and 40 kg N/ha in the eastern zone, where the subsoil constraint caps the crop's ability to convert additional nitrogen into grain. The expected response in the west is an additional 0.6 to 1.0 t/ha in an average-to-good season. The downside: if the season turns dry after stem elongation, the additional nitrogen may not be recovered. The producer agrees. Continuing the flat rate is assessed as likely to leave profitable production unrealised in the west (the yield ceiling penalty) while spending on a constrained response in the east (the sinkhole effect). Investigating amelioration of the eastern zone's sodicity is deferred for costing; the record notes this as an action for the following season.

Nitrogen is applied as recommended in late June. An additional top-dress is planned for the western zone in August, conditional on adequate rainfall and crop development. A dry period leads the producer and agronomist to defer. The record notes the deferral, the reason and the decision deadline at which it was made.

At harvest, the western zone yields 3.6 t/ha (up from a two-year average of 2.9 t/ha), despite the deferred top-dress. The eastern zone yields 2.1 t/ha, consistent with its previous average. Total input cost is marginally higher than the flat-rate alternative; gross margin per hectare is higher.

The agronomist's review notes three things. The western zone responded even without the August top-dress, suggesting further capacity in a season with better spring rainfall - the kind of favourable-season upside the yield-gap research identifies as systematically missed [7]. The August deferral was sound given conditions; the record preserves the reasoning for comparison with future seasons. The eastern zone's constraint has been contained rather than addressed; gypsum investigation is flagged as a risk-adjusted opportunity for the next planning cycle.

Had the season turned dry, the additional nitrogen in the west would not have been recovered. The value of the record in that scenario is not that it prevents the loss but that it preserves the reasoning: a sound decision can be distinguished from its unfavourable outcome, and the next season's starting point is better informed than memory alone can provide.

The assessments described in this part share a common dependency. Each requires evidence that connects across seasons, paddocks and decisions. The comparisons that reveal whether productive capacity is being maintained or drawn down require consistency that memory and disconnected records cannot sustain.

Part 4. Digital records and adoption

Information has practical value when it can be interpreted in context and tied to a decision. Technology earns its place when it makes this easier: bringing relevant records together, drawing attention to a change that matters and preserving what was decided and what happened.

The minimum record of account (MRA)

An MRA is the minimum connected record needed to establish what was known, what was recommended, what was decided, what was done and what followed. It will vary with enterprise, and decision. Its usefulness also depends on the relevance, reliability and accessibility of the records.

For example, estimating what a paddock could have produced requires the sowing date, cultivar maturity, plant density, soil water-holding capacity and a long run of local weather data, not the yield alone [5]. This information would be assessed against the six steps in Part 3: location and context; evidence; recommendation and rationale; decision and action; costs and resources; outcome and review.

The evidence an MRA draws on extends beyond agronomic records. Farm plans, commodity contracts, insurance policies and machinery logs each carry information that bears on input decisions. A nitrogen application depends not only on soil and crop conditions but on the cash available, the labour to apply it and the price locked in for the grain.

Multi-season records can then influence a producer's assessment of risk by revealing, and often visualising, the actual distribution of outcomes from past decisions.

Farm management software, precision agriculture platforms and accounting systems already record much of what happens on a farm. These are not broken systems; they work for the purposes they were designed for. What they typically lack is the connection between the evidence that informed a decision, the reasoning behind it, the action taken and the result that followed. The MRA does not replace these tools. It defines what "complete enough to learn from" looks like and structures the connection between records that already exist but are not linked to the decision they supported.

Manual compilation at this resolution is an administrative burden no agronomist or producer could sustain. Digital integration is what makes an MRA feasible. Direct observation and digital measurement, used together with the limits of each understood, will produce better judgement than either alone.

Integration, data quality and governance

A qualitative case study of a cotton-farming community on Queensland's Darling Downs described adoption issues related to devices and software that do not connect to each other or to decisions; doubt about data accuracy; uneven data skills; and unclear rules on who owns and may use farm data [20].

Sensors, satellite imagery, geospatial analysis and yield monitoring supply information that would be slow or costly to gather by observation, but data from different sources can differ in format, scale, definition and accuracy. Their integration needs consistent identification of farms, paddocks and zones; clear dates and units; a stated source for each measurement; and a way to distinguish observed data from estimates and model outputs.



The technical architecture for connecting these systems is beyond the scope of this paper. A pilot would need to identify which existing platforms can supply the required data fields and what integration work is needed.

Once the required data fields and review processes are defined, connected systems can generate seasonal summaries, flag departures from plan and assemble compliance documentation with less manual handling. However, governance matters equally. Producers and advisers need to know what is collected, who can access it and how it may be used.

Adoption and implementation

Digital adoption has a financial implication. Process change on a working farm requires investment, time and a change in how the operation runs. The financial and human resources needed to make the change and keep it in place must be part of the assessment.

The cost of establishing an MRA cannot be estimated in advance of a working implementation. A pilot would need to track costs alongside any change in decision quality or financial outcome, so that the cost of maintaining the MRA can be weighed against the cost of continuing without one.

Adoption starts with a clear decision problem and a manageable level of record-keeping. Dowling's discussion of nitrogen budgeting, balance and banking illustrates this: each approach has strengths and limits, but recording inputs and outputs over time is what supports tracking nitrogen efficiency, soil fertility and fertiliser risk ^[21]. Agronomists are well placed to establish the practice, and in most cases they are the critical path. They already work with producers on soil constraints, input recommendations and paddock performance. In a survey of 232 wheat producers, farms with smaller yield gaps were more likely to use and trust a fee-for-service agronomist (71% vs 52%), apply more nitrogen and soil-test more of their area ^[22]. The practices the MRA formalises are the same practices associated with narrower yield gaps, and agronomists are already present in the advisory relationships where those practices occur.

Adoption can be tested practically: does the record reduce the time needed to find information, identify a constraint earlier, improve the basis for a recommendation, or avoid unnecessary spending? The commercial value for producers rests on better evidence for decisions; for agronomy businesses, integrated records support continuity of advice. A structured record also reduces the administrative burden of compliance and sustainability reporting.

If the agronomist's role in establishing and sustaining the MRA is this central, the question extends beyond individual adoption: is the advisory business as it currently operates structured to support it?

Part 5. The advisory transition

The role expected of agronomists has shifted over several decades, from primarily field-based biological assessment to a broader function that includes interpreting digital data, managing spatial records and supporting compliance and sustainability reporting ^[23]. The commercial model for independent agronomy advice has been slower to change. Revenue remains largely built around paddock inspections, seasonal recommendations and per-hectare advisory fees, a structure that predates most of the digital and regulatory demands now placed on the role.

Adopting digital tools has not, by itself, changed this. Research into digital AgTech adoption found that agronomists were reluctant to adopt a data-interpretation role, citing doubt about sensor-data reliability, concern that dependence on digital tools would erode field-based skills, and uncertainty about commercial recognition ^[20].

If the goal is to establish an MRA as working practice, the agronomy business is where the transition has to happen. Producers adopt practices their agronomist supports. This requires agronomists to think beyond season-to-season yield and profit. If the goal is inter-generational farm planning, the frame for assessing advice must match.

The transition involves three things: people who are confident in the data and have a clear reason to maintain it; processes linked to the season, the paddock and the decision; and technology that connects what is collected to what is decided.

The commercial proposition is that connected records support a broader and more defensible advisory service. An agronomist who can show a producer the trajectory of a paddock's productive capacity, the return on past input decisions and the basis for this season's recommendation is offering something a product-attached recommendation does not. Whether an MRA-based advisory service commands a fee that covers its cost is an open question. A pilot would need to test both: whether the practice improves recommendations, and whether that improvement is commercially sustainable.

Conclusion

Soil condition determines what any input can achieve. Understanding productive capacity and its constraints is the first step; the second is assessing decisions against that understanding.

Risk-adjusted opportunity translates that understanding into a forward assessment: given the evidence, the cost and conditions of acting, and the farm's capacity to carry the action, is the proposed input likely to pay? Risk-adjusted return closes the loop: did the decision deliver what was expected, and what does the difference reveal?

Connecting these assessments across seasons requires a record that links evidence, recommendation, decision, action, cost and result. An MRA provides that connection. Without it, the reasoning behind decisions stays in memory, assumptions go untested, and the same mistakes recur without being recognised as patterns. Digital integration makes the MRA practical to maintain and query across the timeframes that matter.

The wider purpose is inter-generational: managing the farm as a productive asset whose viability extends beyond any single operator's tenure. Decisions that extract value from soil capacity without replenishing it can look profitable in one season and erode the asset over time. An MRA makes it possible to distinguish decisions that maintain capacity from those that draw it down.

Agronomists are the critical path. The advisory business model needs to change to support it, from seasonal prescription toward a service built on continuity, review and demonstrable value across years.

Whether an MRA changes decisions or improves returns is untested. The case set out here is that the logic is sound, the evidence for each component is established, and the tools to build and maintain the record exist. The necessary next step is to test it.



References

- [1] Orton, T. G., Mallawaarachchi, T., Pringle, M. J., Menzies, N. W., Dalal, R. C., Kopittke, P. M., Searle, R., Hochman, Z. and Dang, Y. P. (2018). Quantifying the economic impact of soil constraints on Australian agriculture: a case study of wheat. *Land Degradation & Development*, 29, 3866-3875. <https://doi.org/10.1002/ldr.3130>
- [2] Hunt, J., Murray, J. and Maddern, K. (2022, 23 February). Managing N fertiliser to profitably close yield gaps. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2022/02/managing-n-fertiliser-to-profitably-close-yield-gaps>
- [3] CSIRO. (2021). National Water-use Efficiency Initiative: researching water use efficiency for increased grain yield. <https://www.csiro.au/en/research/plants/crops/farming-systems/wue-initiative> (page last updated 21 May 2021)
- [4] Hochman, Z., Gobbett, D., Horan, H. and Navarro Garcia, J. (2016). Data-rich yield gap analysis of wheat in Australia. *Field Crops Research*, 197, 97-113. <https://doi.org/10.1016/j.fcr.2016.08.017>
- [5] van Ittersum, M. K., Cassman, K. G., Grassini, P., Wolf, J., Titttonell, P. and Hochman, Z. (2013). Yield gap analysis with local to global relevance: a review. *Field Crops Research*, 143, 4-17. <https://doi.org/10.1016/j.fcr.2012.09.009>
- [6] Hochman, Z. and Horan, H. (2018). Causes of wheat yield gaps and opportunities to advance the water-limited yield frontier in Australia. *Field Crops Research*, 228, 20-30. <https://doi.org/10.1016/j.fcr.2018.08.023>
- [7] Lawes, R., Van Rees, H., Whish, J., Vadakattu, G., Gobbett, D., Ouzman, J., Chen, C. and Ota, N. (2020, 12 February). The yield gap calculator and implications of the national paddock survey for Western Australia. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2020/02/the-yield-gap-calculator-and-implications-of-the-national-paddock-survey-for-western-australia>
- [8] Monjardino, M., Hochman, Z. and Horan, H. (2019). Yield potential determines Australian wheat growers' capacity to close yield gaps while mitigating economic risk. *Agronomy for Sustainable Development*, 39, 49. <https://doi.org/10.1007/s13593-019-0595-x>
- [9] Sadras, V. O., Hayman, P. T., Rodriguez, D., Monjardino, M., Bielich, M., Unkovich, M., Mudge, B. and Wang, E. (2016). Interactions between water and nitrogen in Australian cropping systems: physiological, agronomic, economic, breeding and modelling perspectives. *Crop & Pasture Science*, 67, 1019-1053. <https://doi.org/10.1071/CP16027>
- [10] Fischer, R. A., Byerlee, D. and Edmeades, G. O. (2014). Crop yields and global food security: will yield increase continue to feed the world? ACIAR Monograph No. 158. Australian Centre for International Agricultural Research, Canberra (p. 97).
- [11] Manson, J., Porker, K., Flohr, B., Garba, I., Gaydon, D. et al. (2026, 23 July). Profitable yield frontiers: how do we know that wheat crops are set up for success before we know what the season will do? GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2026/07/profitable-yield-frontiers-how-do-we-know-that-wheat-crops-are-set-up-for-success-before-we-know-what-the-season-will-do>



- [12] Porker, K., Flohr, B., Manson, J., Garba, I., Gaydon, D. et al. (2026, 29 January). Profitable Yield Frontiers: setting crops up to capture yield potential. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2026/02/profitable-yield-frontiers-setting-crops-up-to-capture-yield-potential>
- [13] CSIRO and Bureau of Meteorology. (2024). State of the Climate 2024. Commonwealth of Australia. <https://www.csiro.au/en/research/environmental-impacts/climate-change/State-of-the-Climite>
- [14] Hughes, N., Galeano, D. and Hatfield-Dodds, S. (2019). The effects of drought and climate variability on Australian farms. ABARES Insights, Issue 6, December 2019. <https://www.agriculture.gov.au/abares/products/insights/effects-of-drought-and-climate-variability-on-Australian-farms>
- [15] Kimura, S., Antón, J. and LeThi, C. (2010). Farm level analysis of risk and risk management strategies and policies: cross country analysis. OECD Food, Agriculture and Fisheries Papers, No. 26, OECD Publishing, Paris. <https://doi.org/10.1787/5kmd6b5rl5kd-en>
- [16] Griffiths, B. (2024, 30 July). Using precision ag to understand constraints to crop production. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2024/07/using-precision-ag-to-understand-constraints-to-crop-production>
- [17] Tilse, M. J., Bishop, T. F. A., Triantafyllis, J. and Filippi, P. (2022). Mapping the impact of subsoil constraints on soil available water capacity and potential crop yield. Crop & Pasture Science, 73(6), 636-651. <https://doi.org/10.1071/CP21627>
- [18] Grains Research and Development Corporation. (2024). GRDC Annual Report 2023-24. GRDC, Canberra. https://grdc.com.au/_data/assets/pdf_file/0017/611270/AnnualReport-2023-24.pdf
- [19] Hunt, J. and Wallace, A. (2023, 21 February). A systems approach to nitrogen management. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2023/02/a-systems-approach-to-nitrogen-management>
- [20] Marshall, A., Turner, K., Richards, C., Foth, M. and Dezuanni, M. (2022). Critical factors of digital AgTech adoption on Australian farms: from digital to data divide. Information, Communication & Society, 25(6), 868-886. <https://doi.org/10.1080/1369118X.2022.2056712>
- [21] Dowling, C. (2024, 13 August). N Bank, N Budget, N Balance: Which is right for me? GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2024/08/n-bank,-n-budget,-n-balance-which-is-right-for-me>
- [22] Zhang, A., Hochman, Z., Horan, H., Navarro Garcia, J., Das, B. T. and Waldner, F. (2019). Socio-psychological and management drivers explain farm level wheat yield gaps in Australia. Agronomy for Sustainable Development, 39, 10. <https://doi.org/10.1007/s13593-019-0556-4>
- [23] Keogh, M. (2016). The changing face of Australian agriculture: Human capital and advisory roles. Australian Farm Institute.
- [24] Bell, L. and Schwenke, G. (2022). A systems approach to nitrogen management. GRDC Update Papers. <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2022/02/a-systems-approach-to-nitrogen-management>