



# Reframing the conversation on agricultural innovation in Australia

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## **Acknowledgement**

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# Introduction

There is a growing appetite across industry, government and communities for a forward-looking discussion on how Australian agricultural innovation policy can respond to the expanding and interconnected goals of the agriculture and food sectors. New goals relate to environmental, social sustainability and equity concerns. Tackling these will require an expanded repertoire of innovation responses that include the ability to deploy technology, but also other ways of converting ideas into value (Herrero et al., 2020). The purpose of this note is to reach out to and grow a community that is interested in how agricultural innovation policy can support a response to this emerging agenda. The purpose of this note is to set the scene, explaining why an expanded innovation policy narrative is needed that reflects the wider goals of the agriculture and food sectors. The note makes some suggestions on themes that might be useful in reframing conversations about these narratives. It begins by reminding us that Australia has firm foundations for moving ahead and expanding the scope of its agricultural innovation capacity.

## Valuing what we have

Australia's agricultural innovation system has developed and evolved to support the changing needs of the sector over the past century. Currently, a core structure of this system is commodity levy-funded Rural Research and Development Corporations (RDCs). Established in 1989, the RDCs remain a significant institutional innovation, legislating government and industry to co-invest in agricultural research and development (R&D). The RDCs continue to provide a highly effective way of coupling farmers' and agricultural industries' demand for technology with technology suppliers in Australia's well-developed agricultural science base. This has enabled the development of interlinked roles of universities, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), farming groups, state governments and other key organisations to advance solutions for productivity challenges of different agricultural commodities. R&D arrangements framed by the RDCs have allowed the sector to increase productivity and remain internationally competitive despite Australia's unforgiving climate and subsidy-free regime. It has also allowed the country to maintain, and frequently renew, its agricultural science and research capability, while continuously cultivating links into the global R&D landscape.

Australia's agricultural innovation arrangements framed by the RDCs are not only unique in the way they are organised and resourced, but arguably uniquely successful and something to be built upon. And yet, while Australia has succeeded with a highly internationalised research system, this consolidated R&D model might need adaptations and additions to respond to the expanding goals and uncertainty of agriculture and food sectors and systems. Now is the time to explore opportunities to improve existing arrangements and extract greater efficiencies and refresh relevance.

## An expanding global innovation agenda

Australia, like many countries around the world, is recognising that innovation arrangements put in place in the 20<sup>th</sup> century, mainly aimed at increasing food production and spurring economic growth after World War II, might need a refresh to deal with the fundamentally different challenges of the 21<sup>st</sup> century. There is growing sense that innovation driven mainly by market and

immediate farm-level interests is failing to tackle a series of environmental sustainability and equity issues that nobody owns, but that everybody is affected by (Hall and Dijman, 2019). These challenges are well-known and no longer controversial (Rockstrom et al., 2023; Willett et al., 2019). They include loss of biodiversity; addressing the causes and consequences of climate change; pest, weed and disease management; the declining vibrancy of rural communities; the health-related consequences of current food system developments; and the inequitable distribution of burdens and benefits associated with these challenges and proposed solutions - to name but a few. Dealing with this is not the responsibility of agricultural innovation alone and implies a whole of economy shift. Nevertheless, these issues are now integral to agriculture and food system performance concerns such as international competitiveness or market access, because environmental and social sustainability are becoming non-negotiable expectations of consumers and investors alike.

Various initiatives exist in Australian agriculture to address these sustainability and equity issues, such as the Agriculture and Land Sectoral Plan, Ag2050, industry sustainability plans and more. However, this expanding innovation agenda challenges the current agricultural innovation system, cutting across existing agricultural industry interests as well as research and innovation portfolios. While technology remains important, innovation in, for example, governance and coordination mechanisms is going to be critical in helping industries and communities navigate towards more sustainable production and consumption systems (Herrero et al., 2020). The issues are no longer neatly bound by agriculture. For example, innovation for emissions reduction is going to need to work at the nexus of agriculture, energy, labour, waste management and manufacturing. Similarly, innovation for healthy diets is going to have to work at the nexus of food, health, education, and business innovation. All of this will need a combination of both technological change, but also innovation and adaptation in the systems and structures that enable the deployment of solutions in these complex cross-sectoral domains (Hall and Dijkman, 2019). More generally, environmental and equity concerns are going to need to play a much more prominent role in choices about directions for innovation (Tschersich and Kok, 2022). Ultimately, metrics, indicators and safeguard arrangements will be needed together with wider debate and socio-cultural change to steer innovation towards linked social, environmental and economic goals (Kemp et al., 2022).

## Innovation reframed

None of these issues are unique to Australia nor indeed to the agricultural sector. Across the globe a range of innovation policy perspectives have emerged with this problem in mind. Research on sustainability transitions has highlighted how lock-ins across transport, energy and food systems can prevent or dramatically slow efforts at redirecting these systems towards more sustainable pathways. Transformative innovation policy perspectives (so called innovation 3.0) point to the need to open up innovation priorities and choices to a broader set of societal interests to be purposeful, equitable and inclusive about the goals to which innovation capacity and investment is being directed (Schot and Steinmueller, 2018). Slightly different again, mission-orientated innovation policy (MOIP) suggests that public investment in the resolution of tightly defined sustainability and similar challenges can concentrate effort, shape markets, crowd-in private sector investment and, in the process, realign innovation systems towards society's grand challenges (Mazzucato, 2018).

What is often lost among the headlines of these somewhat confronting innovation policy perspectives, is the idea of policy layering (Schot and Steinmueller, 2018). Put simply, the idea of layering recognises that many innovation approaches, organisations and capabilities that have served us well in the past, are still required, albeit with some updating. This includes, for example, R&D-driven research, technology commercialisation and the knowledge brokering and intermediary functions that support these processes. It is not the case that these need to be necessarily completely thrown out or replaced, although some may need to be reoriented and supplemented to strengthen relevance. Rather, established and newer innovation practice and policy ideas, approaches and priorities need to be mixed and assimilated to generate a system that is appropriate to the tasks at hand. With little practical advice on how to achieve this, broadening the scope of innovation policy remains a considerable challenge (Haddad et al., 2022).

## Innovation narratives and why these need to be refreshed

At the heart of this challenge is the way innovation policy tends to proceed along existing pathways. This path dependency is driven by a tacitly accepted narrative of technological change and innovation that frames investment options and performance criteria (Conti et al., 2024, 2021). Somewhat counter-intuitively, these narratives seem to have acquired enduring properties that see them transmitted uncritically between communities and generations of researchers and policy makers.

In short (and in very simplified terms) this narrative links investment in science and technology with societal outcomes. Technology is typified as leading relatively straightforwardly to a proliferation of products and increases in productivity, most often through efficiency gains. In this narrative, science and technology are often taken as being synonymous with innovation, so much so that technologies are referred to as ‘innovations’. In turn, science and technology are often envisaged as being different parts of a pipeline, with blue-sky science leading to applied science which refines technologies that can be trialled and commercialised. Here, innovation is irrefutably good, and the way innovation processes lead to different societal outcomes, or its directionality, is unquestioned.

The dominance of this narrative sets up a particular and limited set of outcomes. For example, innovation policy deliberations and associated political discourse become preoccupied with certain sorts of investment such as R&D, certain sorts of organisational arrangement to deliver innovation (in our case the RDCs) and certain sorts of innovation performance criteria. For example, this narrative can be seen to play out in research evaluation traditions where dominant approaches focus on measuring economic impacts, often at the expense of understanding other types of results, including lessons on how innovation actually happens (Hall, 2005). These innovation policy preoccupations are not problematic in themselves when applied to circumstances for which they fit. However, what is problematic is when the world changes around them, and new types of investment, delivery and indicators are needed. Despite change, these narratives continue to give primacy to a narrow set of preoccupations and, in the process, leave little room or legitimacy for other innovation concerns and perspectives – especially those needed to meet the demands of increasingly uncertain futures.

These points highlight the interesting inflection point reached by Australian agricultural innovation policy. The agricultural innovation system (or more accurately, public and private co-investments supporting agricultural R&D) is actually doing the job it was set up to do – commodity-based productivity enhancing innovation. However, at the same time, there is a recognition that the ‘job’ has expanded and become more complex. To tackle the innovation implications of the agri-food system transformation agenda (shorthand for shifting toward environmental and social sustainability), the innovation policy narrative needs to be expanded and elaborated to make space for new preoccupations. In particular, the transformation agenda is framed by calls for a broad range of innovation responses that go beyond ‘technological fixes. Instead, it needs to span eco-socio-technical domains in a way that (i) remedies and reverses the interlinked undesirable outcomes of the agri-food system, such as emission or nitrogen run off; (ii) goes beyond the traditional boundaries of agriculture and food to develop solutions spanning across food, nutrition, health, energy, and transport; (iii) considers system and structural change; and ultimately; (iv) enables a fundamental re-structure of current systems to meet expanding goals of environmental soundness, economic equity, democracy and inclusion, that sit alongside ambitions of productivity growth and international competitiveness.

This transformation is not going to happen overnight and requires as much cultural shift as it is evidence- and metrics-based and therefore difficult to prescribe. Innovation metrics are predicated on the deep-rooted notion that R&D investment (and their economic returns) is what needs to be measured. This view favours shorter-term economic impacts (largely delivered through technological innovation) versus lengthier, but possibly more profound, social, cultural, and political innovation (Schot and Steinmueller, 2018). Novel impact metrics and M&E frameworks might therefore need to be revisited. A first step for this is to convene a different conversation on agricultural innovation, what it seeks to achieve and how it can be supported.

Before coming on to how this might be done, it is first worth revisiting two key ideas in this discussion – innovation policy and innovation systems. While these are powerful ideas, they may in fact be part of the challenges constraining the current innovation policy narrative. Unpacking them a little bit helps point to issues to be considered in the new innovation policy conversation.

## Innovation concepts: a help or a hindrance?

The first concept is innovation policy, which was introduced above. In the strictest sense there is no such thing as an innovation policy in the way that there can be discreet policies on, for example, education, agricultural subsidies or immigration. Innovation usually involves many different aspects of social and economic activity pulling in the same direction, inevitably involving some combination of business, finance, education (skills) and research. In this way innovation policy is not a single policy, but a cluster of policies coordinated across different ministerial portfolios. A few countries have tried (not very successfully) to address this by establishing innovation councils or similar bodies mandated to coordinate across Ministries. (Innovate UK is a British example, while the European experience with MOIP is highlighting the need to address the challenge of cross-ministerial coordination (Björk et al., 2022)).

Without coordination, innovation policy tends to become an ad-hoc outgrowth of different portfolios with divergent mandates and existing goals (Edquist, 2019). For example, innovation policy often becomes an outgrowth of Ministries of Science and Technology, where the

preoccupations are with research priority setting, patterns and impacts of technology adoption and impact, research granting arrangements and their impact, and building capability associated with new platform technologies such as industry 4.0. In cases where research and higher education sit within the same ministerial portfolio, innovation preoccupations tend to be with commercialisation of university research.

In other cases where innovation policy is an outgrowth of an industry policy, innovation preoccupations tend to focus on the capability of firms to absorb technology, and the provision of skills and resources needed for business development. It has been common practice in countries where a national innovation strategy is in place, to leave it to individual ministries to frame their own innovation action plans. Here again this leads to the reproduction of existing innovation preoccupations. This is due, for instance, to the prioritisation of immediate industry needs within government cycles, the dominance of existing innovation narratives, the siloed ministries setting sector boundaries (and poor coordination between these ministries), and overall institutional inertia, which ultimately lead to the persistence of existing trajectories versus novel ones that might be more aligned with the new century's ambitions. For example, in ministries of agriculture, preoccupations tend to be with research and extension systems, technology adoption and impact assessment. These preoccupations in themselves are not problematic, however, it is the way these crowd out other innovation concerns and priorities, potentially excluding alternatives.

This reveals a paradox about innovation policy. Instead of assessing and targeting the types of investment that can support innovation, it tends in some instances to reinforce and replicate (or perhaps be captured by) existing innovation narratives even where these have outlived their usefulness. This begs the question how could innovation policy be reimagined as to encompass different or an expanded set of preoccupations?

A second fundamental concept is that of an innovation system. The innovation system concept has been extremely powerful and influential in shaping innovation policy thinking (notwithstanding the caveats mentioned above) to understand the distributed and networked nature of the capability and resources needed for innovation. However, there are different views on what this concept means, how to represent it, and how it should be used.

Firstly, there are debates about the boundaries of innovation systems. Common framings use national, regional or sectoral boundaries. Each of these framings has merits as well as drawbacks as ways of framing policy analysis and design. The concept of national systems is a powerful way of representing the idea that there are distinct national styles of innovation, and that innovation emerges from a constellation of activities distributed across nationally bounded economic and social systems. In a globalised world, this national bounding has become problematic. As a diagnostic tool it lacks the level of precision needed to identify actionable policy tasks. From a policy perspective, the absence of a ministry or national agency with responsibility for supporting the development of an innovation system is problematic, raising questions of where leadership for this activity lies. Experiences of establishing national innovation systems agencies have been mixed, although there has been renewed interest in some countries, for example, Te Ara Paerangi in New Zealand, and Innovate UK in the UK.

The concept of regional (rather than a national) innovation systems is a logical way to explore the place-based interactions and processes that drive innovation, including the synergies between different areas of economic and social activity. This is particularly powerful, for example, in

exploring regional sustainability transitions. However, in many countries it neither fits neatly into either nationally-framed innovation strategies or into portfolio-based innovation policy such as agriculture, industry and energy, suggesting additional coordination mechanisms need to be in place. In a country like Australia (geographically large but with a small industrial base and population) it can negatively impact innovation by reducing the benefits of scale, which are often critical to driving the productivity required to make innovation viable.

Alternatively the concept of sectoral innovation systems has been suggested and applied to sectors including agricultural and food innovation (World Bank, 2012). It seems to make sense that specific sectors have distinctive innovation challenges and capabilities that require tailored policy attention and support. However, as already discussed, in reality innovation concerns and challenges are no longer neatly bounded by sectors but characterised by cross-sectoral interactions.

In summary, the concept of innovation systems, expressed via different scale and boundary framings above, has challenges representing both the appropriate scope of innovation activity, as well as the interactions between actors and causal relationship with policy (national development, regional development, sectoral development). This begs the question of what a visualisation would look like that represents the scope of innovation activity associated with, for example, new cross-cutting environmental and social sustainability challenges (Elzinga et al., 2023).

The second issue with the innovation system concept is that unfortunately, and rather paradoxically, its application tends to reinforce the innovation policy preoccupations mentioned earlier rather than help frame new policy mixes and priorities. The problem lies in different interpretations of what is understood by an innovation system. Some views suggest that innovation systems are self-organising arrangements and networks that emerge in ways that reflect the search by businesses and other organisations for ideas and information needed to respond to new challenges and opportunities. In contrast, some view an innovation system as something that is purposefully constructed by policy through investments in capability and coordinating mechanisms. Of course, the reality usually lies somewhere between these two extremes, with policy playing a role in designs to meet desirable outcomes, filling gaps to address failures, and providing direction and support to self-organisation.

Unfortunately, the idea of an innovation system is all too often used in the ‘purposefully constructed’ sense, representing innovation arrangements framed by existing innovation narrative preoccupations. For example, the Australian agricultural innovation system is described (including in the introduction to this note) as the R&D and technology transfer arrangements that have been the long-standing levers for supporting agricultural innovation. This makes a lot of sense. After all it is helpful to visualise the agricultural innovation system in this way as it focuses attention on the organisations and resources (research capability and funding) that policy has direct control over (given current policy instruments). The trouble is that it paints a picture of a very R&D-centric agricultural innovation system heavily reliant on public funding and organisation. Once again this reinforces existing preoccupations in the agricultural narrative, excluding consideration of self-organising parts of the innovation system that may have high relevance to a broadening innovation agenda associated with environmental and social sustainability concerns. What would an innovation system look like that combined the narrow ‘constructed system’ view with recognition that there is value out in the ‘innovation wilds’ of self-organising problem solving?



# What does the new agricultural innovation policy conversation need to consider?

For many of the reasons discussed above, refreshing agricultural innovation policy is not a research task driven by experts. Rather it is a task of connecting change-makers and ideas in a conversation about new innovation directions (and the narrative process that sits behind setting these directions). The issues raised in this note point to several themes that need to be considered in this reframed agricultural innovation conversation.

1. **Innovation: R&D but much more.** Science and technology will continue to be important inputs into the innovation process. However, innovation involves a much broader set of change and adaptation processes. The conversation on how innovation can be mobilised to deal with societal challenges needs to reflect this.
2. **Opening up the conversation to different interests and perspectives.** R&D and agricultural industry stakeholders are already well represented in agricultural innovation discussions. The conversation needs to be opened up to other perspectives and stakeholders, including First Nation and traditional knowledges. Who these other stakeholders should be – and how to host a diverse conversation without the pitfalls of tokenism, corporate capture and chaos – needs to be explored.
3. **The search for a better innovation system visualisation.** How can innovation systems be visualised to reflect innovation at the nexus with other sectors, to reflect innovation activity and resources beyond the R&D system, and to reflect the challenges or goals to which innovation capacity is being directed towards (namely environmental, social, and economic sustainability)?
4. **Collecting and discussing evidence about how innovation takes place beyond and in interaction with the R&D system.** How can the existence of self-organised innovation arrangements be revealed and introduced to the innovation policy discussion?
5. **Getting inspiration from global debates and experience in developing innovation policy.** How can innovation policy discussion be exposed to and take inspiration from the wealth of deliberations and debates on innovation policy as well as from the experiences of other countries exploring ways of implementing new framings of agriculture innovation policy? And how can Australia better position itself as part of a global innovation system?
6. **Matching the scope of innovation systems thinking to the scope of the challenges being faced.** Mental models of innovations systems need to be flexibly adjustable to the scope of the challenges being faced, legitimising more integrated responses to more complex societal challenges as well as responses to challenges amenable to simple technology fixes. Similarly, ways of monitoring progress towards these challenges which span across societies and sectors, might need to be rethought.

If these issues excite you, or you are interested in becoming part of a growing research community that strives to help achieving an agri-food system transformation, reach out and join us in reframing the agricultural innovation narrative.

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