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# Submission

## Productivity Commission - Review of Part 3 of the Future Drought Fund Act: Interim Report

Institute for Water Futures and Centre for Entrepreneurial Agri-Technology

11 July 2023

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**Citation:** Peerson A, van Kerkhoff L, Higgins D and Atkin O 2023 *Submission: Review of Part 3 of the Future Drought Fund Act: Interim Report*. Productivity Commission, Melbourne. Canberra, ACT: Institute for Water Futures (IWF) and Centre for Entrepreneurial Agri-Technology (CEAT), Australian National University. 11 July 2023.

**Acknowledgements:** We acknowledge and celebrate the First Australians on whose traditional lands we work, and pay our respect to the elders past and present.

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TEQSA Provider ID: PRV12002 (Australian University)

CRICOS Provider Code: 00120C

## Contents

Introduction .....	4
The centrality of universities in our research and development (R&D) system.....	4
Agriculture innovation and the role of FDF in supporting research .....	5
Changing systems towards transformational change .....	8
Integrated pathways.....	10
Sustainable Development Goals – enable visioning, transition and transformation.....	11
Engagement with indigenous communities .....	12
Climate adaptation and resilience authority.....	13
A National Mission for Future Crop and Community Resilience.....	14
Conclusion .....	15
References .....	16

## Introduction

Thank you for the opportunity to provide a submission to the Productivity Commission: *Review of Part 3 of the Future Drought Fund Act: Interim Report*. The Productivity Commission has recommended the Future Drought Fund (FDF) program:

- is framed and guided by national priorities
- becomes more explicit in undertaking and investing in significant transformational innovation to achieve its goals of preparedness, adaptation and resilience
- considers broadening its scope from drought resilience to climate change resilience.

The Act is a major long-term commitment with complex goals to support agriculture, regional communities and, now also, natural resource management (NRM).

We have targeted our comments to specific issues raised by the Productivity Commission's interim report, as they relate to the university sector. Recommendations are provided throughout the document.

The authors are experts in water management, drought resilience, climate change, agriculture innovation, strategic planning, community development, organisational and intersectoral collaboration. We have direct and indirect experience with the FDF through membership of the Southern NSW Drought Resilience Innovation and Adoption Hub (SNSW Hub), design of FDF programs, as applicants and recipients under the FDF funding programs, and in conversations with colleagues of other Hubs and agencies elsewhere in Australia. We recognise the FDF is one part of a complex suite of institutional arrangements addressing the challenging issues around the impacts of climate variability, weather extremes, climate change and adaptation, social, economic and environmental resilience.

## The centrality of universities in our research and development (R&D) system

To date, universities have played an underpinning role in the FDF program and funding; more so at the incremental innovation level and in part, supporting regional universities underpinning the Hubs. However, as identified by the review, there is an urgent need to address climate change adaptation; not just drought resilience. To achieve this aim, greater priority and investment in 'Transformational Innovation' is required (Hall et al 2016).<sup>1</sup> Involving harnessing of universities' R&D capacity and capability to address the complex drivers, needs, risks and opportunities associated with climate adaptation for agriculture, regional communities, and the nation.

In Australia, government expenditure on R&D as a percentage of GDP is at a historically low level; ever since records began (Carr 2023, Wesley 2023). Australian universities conduct 35% of the total national research effort, with around 50% of research effort being funded from their own resources. Universities subsidise the research efforts of government and business by using money from international student fee revenue and other teaching income. Basic research funding has now slipped to 22% of total funding; a tipping point threatening the viability of the

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<sup>1</sup> Hall et al (2016) definition of 'Transformational Innovation' is characterised by deep system changes underpinned by a broad-based consensus to significantly advance the economic, social and environmental frontiers of the agricultural sector overall, and open up opportunities for new waves of radical and incremental innovation.

entire research value chain. Our national level of R&D investment needs serious commitment to enable the transformative change agenda required.

Carr (2023) outlines how Australian research has become fragmented, with effort being dispersed across >200 programs in 13 portfolios. This suggests a need for national government to ensure more streamlined and effective ways of engaging stakeholders, but also enabling oversight of a transformative adaptation agenda. New forms of collaboration across jurisdictions, industry, government, research entities and society are urgently needed.

## Agriculture innovation and the role of FDF in supporting research

In the Interim Report, the Productivity Commission (2023:16) states:

*The Commission recognises there are a range of institutions undertaking agriculture innovation (such as universities, industry-led Research and Development Corporations and Cooperative Research Centres) and it is unclear where and how the FDF can and should complement this. The Commission is requesting further information on how the FDF can best add value in the existing innovation system.*

*To the extent there is a role for the FDF to support innovation, the Commission considering the merits of rescoping the program so that it better targets grants toward identified challenges.*

Regarding the role of universities in the Climate and Drought Resilience Innovation System, there are various key gaps not currently met by existing institutions. The sectoral or commodity-based focus of the Research and Development Corporations (RDCs) does foster some climate and drought relevant research and development specific to those industries. Similarly, some Cooperative Research Centres (CRCs) like the new One Basin CRC (2023) have a significant focus on climate adaptation, but this is limited to the geographic region of the Murray-Darling Basin and largely focused on the irrigation industry.

Commodity or sector-based research programs are fundamentally limiting, as they are invariably focused on encouraging and supporting persistence of an industry despite the increasing impacts of climate change. Examples include: increasing water use efficiency or developing more drought resistant crop varieties. Similarly, they tend to underinvest in tackling systemic issues (eg. social or demographic change) and in technologies or land management activities applicable at a broader, landscape scale (eg. managed aquifer recharge). Nor do these programs tend to invest in social or institutional research to enable more diverse responses to climate challenges, and inform evidence-based decision-making and action. In contrast, many scientists argue we need to be considering transformative approaches that may include a wide range of institutional and industrial changes. Universities are uniquely placed to advance innovation for addressing the more systemic and transformative knowledge and capabilities needed for better climate resilience, drought and floods preparedness and early intervention. Such evidence base would assist with farmer, household, community and agency strategies, as well as aid effective coordinated responses for specific population groups (eg. youth, women, small landholders, indigenous people) and in diverse communities (ie. urban, rural, coastal, remote).

There are 4 areas we believe the FDF can target research investment in to make an important contribution to the overall innovation system. Positioning these investments within the FDF creates an opportunity for them to be strategically integrated with other FDF programs and activities, ensuring a sound pathway for research to connect with practice:

1. *Understanding and building societal capacities to transform* - The ability to transform agricultural and other practices to anticipate climate change and act before a crisis hits, is a basic goal of drought and climate resilience. Yet we know relatively little about how and why practitioners, businesses and communities resist change. A strong research program in understanding how and when individuals, organisations and communities feel able to innovate and change, and identifying what options or institutional supports enable transformation, is a key contribution universities can make.

*Example - The current project: 'Sharing early insights for more resilience communities' led by the University of Canberra, detects changes in community wellbeing using everyday data to spot trends in community activity translating into signs of stress. Data from various sources (eg. purchase histories, business turnovers, footy game attendances) can provide early warning indicators for grassroots groups, government and other support organisations to improve service provision and overall community capacity to deal with extreme events. The goal is to identify the early warning signs of changes in community resilience before during and after extreme climate events, and enable rapid, timely responses and ongoing support from organisations.*

2. *Institutional arrangements including water reform* - Effective climate and drought resilience demands critical assessment of current institutional arrangements across the key sectors affecting agricultural production. The processes currently under way to review the Murray-Darling Basin Plan, and the associated *Water Act 2007* are examples of opportunities for change. However, for these opportunities for change to be realised, they need to be supported by thorough and frank critical assessments of current arrangements, plus well-considered alternatives and options that will better fit the goals of climate and drought resilience. Universities are uniquely placed to provide independent, out-of-the-box thinking and analysis.

*Example - climate change impacts and competing water allocation rights for diverse purposes are influencing the environmental health of the Murray Darling Basin. In turn, affecting water security, cultural water flows, wildlife habitat, agricultural productivity and community wellbeing. Managing water resources effectively for daily requirements, plus during extreme events of droughts and floods, relies on improved decision-making, planning and action that is evidence-based and timely. Well-resourced preparedness and early intervention strategies could achieve greater effectiveness in preventing and responding to critical situations. Strategic and local communication, collaboration and coordination across various sectors, organisations and communities requires leadership at system-level and within communities. Integrated policy across multiple sectors is vital, as water is necessary for everyday life in many ways (eg. hygiene, food production, public health, housing, riparian vegetation, climate change adaptation, environmental sustainability). Universities in partnership with other organisations with expertise in community development, participatory action research, foresight, and scenario planning, can contribute to public understanding and discussions. Science communication about climate change adaptation and water management (eg. storytelling, infographics, postcards, comics, videos, film, interactive theatre) could inspire conversations, relationship-building and shared learning. Such an approach could:*

- *illustrate lessons learnt from lived experience and diverse evidence sources*
- *enable use of systems thinking, to avoid silo effects*
- *provide opportunities for assessing and managing vulnerabilities, risks and impacts (ie. environmental, social, economic, political, cultural)*

- *prompt useful insights for determining alternative, feasible approaches for water management, and in response to 'hotter, dryer futures' and potential disruptions to water supply and quality*
- *inform better governance oversight of water allocation and use*
- *enable evidence-based policy development and implementation, indicating climate change adaptation strategies across sectors*
- *identify future research priorities (Alexandra 2022).*

3. *Training the next generations of agricultural leaders* - While existing FDF programs, including those led by the Drought Resilience Hubs have targeted on-farm training, there is a key role for universities to ensure degree programs and other tertiary education opportunities include comprehensive understandings of climate change, climate impacts and long-term strategies for resilience. Collaborations between universities and the FDF can ensure these are targeted and fit-for-purpose in enabling more proactive and innovative decision-making.

*Example - The ANU Institute for Water Futures has supported the creation of a new network of water professional leaders. The 'Next-Gen' project fosters dialogue and collaborative learning across the network, in connection with university mentorship and knowledge sharing. 'Next Generation Basin Workshop Highlights' (YouTube video: <https://www.youtube.com/watch?v=r4wQzCZBvbA&t=28s>)*

4. *Advanced technologies towards a different climate future* - An important part of the innovation system will always be fostering and growing advanced technologies for climate and drought resilience. We believe it would be appropriate for the FDF to manage a seed funding grant round supporting 'blue sky' research that has not yet reached the stage of maturation suitable for other R&D programs. The program should emphasise technologies with potential for widespread application across different sectors, commodities and regions of agricultural production, and draw connections from emerging innovations in other fields (eg. health, defence, data science).

*Example - Managed aquifer recharge is a landscape scale technology to capture excess rainfall runoff, by artificially enhancing recharges into underground aquifers. This technology has the potential to both reduce flood impacts and enhance groundwater storage for later access during dry periods. Yet to date it has been under-invested; as benefits do not flow to a specific sector, industry or area. Targeted investment by FDF in this and similar multi-benefit cross-sector technologies would fill a critical gap in the funding landscape.*

### Recommendation

Provide targeted FDF investment in the areas presented above: 1) understanding and building societal capacities to transform; 2) institutional arrangements including water reform; 3) training the next generations of agriculture leaders; and, 4) advanced technologies towards a different climate future.

## Changing systems towards transformational change

Analysis of the existing R&D system by CEAT and others indicates the agricultural sector expends much of its R&D resources on short-term, incremental Innovation. There are inherently useful roles for this innovation to play in the system. However, it is unsustainable and can also promote maladaptation.

In the face of climate change, it is imperative a greater proportion of R&D resourcing is allocated to transformational innovation, ensuring we can adapt to the serious challenges it poses to our existing systems. It is important to acknowledge that embracing transformational innovation, also means embracing risk. Noting while there can be significant gains, there will also be failures.

Related to the concept of transformational innovation, is the concept of 'Transformational Adaptation', defined by Rickards and Howden (2012) as: 'changes to sociological systems in response to actual and expected impacts of climate change.' They conceptualise it as longer-term, deeper transformation. This also suggests larger scale interventions are flexible not rigid, and the need to carefully manage social-ecological systems, and adaption to relevant bio-physical changes. Wallace and Silander (2018) view it as: 'a fundamental and systemic change aiming for sustained equitable growth based on achieving sustainable societal development.' Social equity and strengthened investment in resilience should be assured at various scales. It requires us to scope, anticipate and design transformation strategies and pathways. Transformative adaption is necessarily interdisciplinary and likely transdisciplinary as an endeavour.

During late 2022, CEAT in collaboration with Policy Partners led *Thought Leadership Workshops* to facilitate dialogues identifying and advancing governance, institutional and policy settings. The aims were to:

- support the agri-innovation system in its delivery of transformational innovation
- enable Australian agriculture to remain globally competitive
- provide leadership in innovation
- strengthen sustainability practices in the value chain
- assist us to address current and future complex challenges.

The 3 workshops drew upon the insights of participants (within and outside the university), with extensive experience of government, policy and regulatory reform. As part of this process, Workshops 2 and 3 focussed on and built on an earlier session:

1. Disentangling the complexities of resilient agriculture
2. Accelerating innovation in agriculture
3. Enabling capabilities for transformative change.

*Workshop 1* - Addressed the theme of 'drought resilience'. It explored the big picture drivers shaping agri-systems, given the institutional, regulatory and policy contexts. The key message arising from the workshop was the pressing need for structural reforms in the agri-system to adapt and transform it, and to manage risks from rapidly changing social, economic and environmental factors. Participants considered Australia needs policy settings embracing (rather than impeding) transformative change in agriculture whilst also recognising and internalising socio-ecological sustainability principles and practices. They emphasised current policy settings across regional development, sustainable natural resource use and agriculture, often lack coherence and integration. Resulting in many piecemeal, fragmented projects.



*Workshop 2* - Considered 'limitations of the existing agri-innovation system', including incremental short- to medium-term changes occurring in the system. In the face of interacting and escalating global challenges (eg. climate change, geopolitical instability, changing energy dynamics, shifting market preferences towards sustainable and ethical agri-food systems). The workshop participants concluded this slow pace of change is inadequate to address these challenges. They identified hallmarks of a transformation-capable innovation system as:

- anticipating and responding rapidly to global risks and opportunities
- driving structural reform through national policy leadership
- coalescing to address agreed national research priorities
- focusing on collaborative models of innovation and drawing on capabilities beyond the agri-innovation sector
- pinpointing indicators of success for a responsive innovation system
- framing principles for how the national research and development effort could be galvanised to facilitate transformation.

*Workshop 3* - Defined the 'scope of a reform agenda', typified by: building collaborations; securing long-term funding arrangements; and, understanding barriers to change from business-as-usual policy settings. It also identified some key operational parameters for a lead 'adaptation' entity.

A lead 'adaptation' entity should be: cross-sectoral; have influence beyond the agricultural sector; and, be capable of working across public and private sectors. It needs to be empowered appropriately for tackling social, economic and environmental outcomes. Operational parameters for the lead 'adaptation' entity include:

- analysing critical weaknesses in the existing innovation system which constrain a focus on transformation
- offering incentives to address complex (Horizon 3 investments) challenges and encourage collaboration
- ensuring long-term security of funding (>10 years) as a basis for collaborative funding models (not just Commonwealth funds but State and private sector co-investment also)
- engaging in discourses that encompass multiple interests and viewpoints, for a better understanding and critical analysis of the problem
- providing national leadership in a reform approach based on a process of facilitation and empowerment, and not marginalising stakeholder interests
- undertaking a process to unpack conceptions of where and how value is created and captured
- scanning for gaps and new opportunities.

## Recommendations

The FDF program engages in foresight and scenario planning activities to help shape priorities and critical investments.

Systems analysis is used to establish and identify significant transformational adaptation opportunities, to deliver benefits to the agriculture sector. In alignment with addressing pre-identified major resilience challenges.

In relation to Transformational Adaptation, the FDF considers: what outcomes they wish to achieve; and, what this means for impact pathways.

## Integrated pathways

The Productivity Commission (2023:2) states: 'The FDF should have fewer, better integrated programs.' The use of a systems thinking approach to the FDF program, projects and activities by each Hub could lead to more timely responsive efforts to address drought resilience and climate change. This would also facilitate better integrated programs.

Currently the agriculture sector tends to operate in silos. It is difficult to engage colleagues in broader discussions affecting the agriculture sector, as one of many sectors influencing Australia's food system (including production, supply and security, and also climate change). These are often considered as separate issues. Consideration of practices, policies, experiential knowledge and a scientific evidence base from other sectors (and systems) could inform collaboration between communities, organisations, universities and Hubs (eg. farmer health, community wellbeing and prosperity, circular economy, renewable energy, emergency management).

*Example - The Australian biosecurity surveillance program has recently improved its operations due systems thinking (ABARES 2023). This approach enabled gaining a comprehensive overview of all activities, and facilitated future thinking, scenario planning and action across the nation, for timely effective responses to potential disease notifications and management of outbreaks. The methodology involved community, specialist, agency and intersectoral participation. Kruger et al (2022b) reveal 'lessons learnt from nine cases studies of general surveillance programs in Australia and New Zealand'. The new guidelines assert 'knowledge integration', use of 'leverage points' and other mechanisms in the biosecurity surveillance system will facilitate communication and coordination within and across the program areas (Kruger et al 2022a). This new approach also has implications at the interface with other systems: animal and plant health; medicine; public health; veterinary, education; law; trade; transport; and, land use planning.*

*Example - Lessons on systems thinking and intersectoral collaboration to enable integrated programs can also be drawn from the Primary Care Partnerships (PCPs) (Victoria) program (2000-22) (Department of Health 2023; Victoria Primary Care Partnerships 2023). This model was based on multiple sectors and agencies working collaboratively to address community-identified needs/priorities. Place-based and intersectoral solutions were sought and implemented within PCP catchment-defined areas in Victoria (n=28). Often involving a single agency with identified expertise taking the lead with input (including in-kind resources) from partner agencies for a specific program or project, funded by government or other sources. In this way, sectors were represented (eg. non-government organisations, universities, health services, philanthropy, transport, housing, education). This was a 22-year opportunity for rural youth issues, dairy farmers' land management, local higher education (and other community-identified) needs to be collectively addressed, with multiple benefits.*

*There were 3 positive reviews of the PCP program during its lifespan, until a global pandemic revealed a limited public health infrastructure and workforce to manage community outbreaks and effects, and other concerns. The PCPs were disbanded for inclusion in the newly established Local Public Health Units (LPHUs) in metropolitan Melbourne and regional Victoria, to re-build and enhance public health capacity and responses in health services and community (eg. health promotion, infection control, chronic disease management) (Department of Health 2023).*

The benefits of integrated programs and collaboration across sectors, organisations and communities include 'social resilience', especially when community input is actively sought and valued to inform new strategies and action potentially affecting their place of home, work and business (eg. Lismore floods, Cobargo bushfires). This requires ongoing strategic and public communication and coordination across sectors, communities and organisations across the FDF (including within Hubs and across Hub borders). An integrated, systemic approach will:

- reduce barriers and provide timely, effective responses to ensure ongoing community wellbeing
- identify opportunities and resource development/implementation of prevention and early intervention initiatives to addressing factors affecting: i) social resilience in everyday life; and, ii) prevention and responses to trauma (natural disasters, critical incidents)
- address time and place, context and scale
- include insights/input from public health and social sciences expertise.

### Recommendations

All FDF programs identify and implement opportunities for building and incentivising: integration of programs and activities; and, models of collaboration across sectors, agencies and communities. This would produce more effective outputs and outcomes, better communication and knowledge dissemination, and improved combined forms of knowledge and skills (expertise).

Use a systems-based approach to invest resources to better address social resilience through collaboration across sectors, agencies and communities.

The FDF could achieve more effective outputs and outcomes through building and incentivising sustained collaboration across its programs

## Sustainable Development Goals – enable visioning, transition and transformation

The current thinking in the FDF plan is for 'incremental, transitional and transformational changes' (Productivity Commission 2023:6). This has implications for the sustainability and governance of the FDF program, and also achieving short- to long term goals. Currently, the FDF does not report on Sustainable Development Goals (SDGs).

Australia is a signatory country to the United Nations with reporting responsibilities on SDGs. An evidence base on FDF progress and achievements of all SDGs could contribute to the national SDGs evidence base and aid reporting.

There is an opportunity for each Hub to report on SDGs as part of the FDF program. The data could be included in the Monitoring, Evaluation and Learning (MEL) quarterly reporting for DAFF, presently used by Hubs for specific programs, projects and activities. A suite of guidelines and resources to aid reporting by Hub agency partners and staff is necessary.

The aggregate data from all FDF programs would yield a national overview of SDG achievements and work in progress. Universities can support the implementation or integration of SDGs into a reporting framework.

*Example - A new SDG 'community of practice' led by the ANU College of Science has become established (2023), to provide leadership in education, research and practice across the university.*

*The involvement of universities in each Hub presents an opportunity for collaborative research between diverse partner agencies with a specific SDG focus (eg. water management, food security) as well as encouraging project reporting. Investment in SDGs-related projects would facilitate science communication and engagement with communities and organisations within the catchment of each Hub. Further fostering targeted responses to climate change.*

Investment in SDGs-related projects would facilitate science communication and engagement with communities and organisations within the catchment of each Hub. Further fostering targeted responses to climate change.

### Recommendations

The Department for Agriculture, Forestry and Fisheries (DAFF) consults with university sector partners, to determine the approach for reporting on SDGs for all programs and projects, including development of guidelines and resources to aid reporting.

All Hubs report on their progress and achievements of implementing SDGs for all projects and programs in the MEL database each quarter.

The SDGs progress and achievements for all Hubs is publicly transparent by DAFF to communities and organisations within the catchment area of each Hub.

## Engagement with indigenous communities

The Productivity Commission (2023) seeks ‘Changes in FDF objectives, design, development, delivery, partnerships and decision-making’ to improve outcomes. In particular, ‘improving opportunities for Aboriginal and Torres Strait Islander people’ (2023:14). This is vital to enhance the wellbeing and prosperity of all indigenous people across the nation. But also, within the catchment area of each Hub.

There are opportunities for university sector to engage and collaborate with indigenous communities, addressing climate change, agricultural, community wellbeing and other identified concerns.

A recent baseline study (situational analysis) and 5 case studies (in-depth analysis) of the ‘agricultural capacity of the indigenous estate’ (Barnett et al 2022a, McArthur et al 2022) reveal that despite holding some form of title over almost 50% of Australia’s landmass:

- the participation of indigenous people in current ‘modern Australian agriculture, fishing and aquaculture industries’ (ie. primary production) is very limited
- where primary production by indigenous people does exist, that is, ‘2% of the Australian agricultural estate ... these enterprises deploy conventional primary production practice, are based exclusively on the application of TEK [traditional ecological knowledge] or deploy hybrid models that endeavour to produce economic surplus as well as other environmental, social and cultural benefits’ (Barnett et al 2022:15)

This has implications for the agriculture sector specifically in terms of recognising indigenous people’s: 1) traditional ecological knowledge (TEK); and 2) intellectual property - of concern to IP Australia (2023), and other entities.

Financial, research and advisory services are necessary to support ‘primary production businesses’ by indigenous people (Barnett et al 2022:16). Potential new enterprise(s) could include:

- studies on the nutritional, pharmaceutical and other properties of bushfoods and medicines (eg. The Orana Foundation in partnership with the University of Adelaide)
- establishing community gardens in rural and remote areas including indigenous people (eg. Tumut, NSW; Narrogin, WA)
- agribusiness (eg. Waminda Sustainable Permaculture and Bush Tucker Rural Industry Project)
- offering agritourism and eco-tourism opportunities for community members and visitors, registered with and promoted by state/territory, regional entities and local government tourism agencies (eg. Northern Territory Travel; Margaret River Region; Orange Region Tourism)
- cultural tourism opportunities on Country (eg. Koomal Dreaming in Yallingup, WA).

Goodwill, communication and collaboration across diverse interests within each Hub can be achieved, by identifying immediate and prospective enterprise opportunities.

It is likely new indigenous enterprise(s), in urban, rural, coastal and remote communities, will enhance indigenous people's social resilience and economic development. Having 'technical, commercial and governance capability-building exercises' in place will aid successful development and implementation (Barnett et al 2022a:15). Regular reporting on each enterprise's activities and outcomes (as already occurring for other Hub programs and projects) will foster public acceptability and transparency, and could inform new opportunities and collaborations.

### Recommendation

The FDF provides investment incentives through the Hubs to kick-start new indigenous-led enterprise(s).

## Climate adaptation and resilience authority

Given the scope of the reform agenda and the nature of leadership needed to drive 'transformative adaptation' to climate change, several workshop participants asserted there is a case for establishing a new Climate Adaptation and Resilience Authority. The remit of such an authority focuses on climate change adaption to address the needs of both agriculture and the environment (natural resource management), and on building resilience across sectors and communities. There is a clear need for a delivery model to be:

- independent of government
- future focussed
- technically skilled
- transparent and flexible in its operations
- capable of attracting funds from multiple public and private sources.

In summary, this suggests the delivery model cannot occur through an existing portfolio of a federal government agency, but could be a statutory agency, a not-for-profit NGO, or single or multiple university-based institute or centre. This necessarily needs to be comprised of interdependent, relevant expertise.

## Recommendation

The FDF considers scoping the need for a new entity at arm's length from government, to lead and manage a national entity focusing on Transformational Innovation and Transformational Adaptation to climate change.

# A National Mission for Future Crop and Community Resilience

CEAT is advocating the need to consider Missions (industrial-level strategies) to drive transformational innovation activities in the Australian context. These strategies have been adopted by the UK, Ireland and other European countries to address complex and escalating issues associated with human-induced climate change. Missions have the following characteristics:

- are measurable, ambitious and time-bound targets, with potential to become a significant vehicle for change
- tackle societal challenges by taking a purpose-oriented, market-shaping approach (eg. climate change, global health)
- determine direction(s) for a solution, but do not specify how to achieve success
- exemplify what transformative innovation could look like.

Currently a *National Mission for Future Crop and Community Resilience* is being advanced by the Australian National University, University of Adelaide, University of Queensland and University of Western Australia; with input from industry, researchers and communities. The *National Mission* seeks to:

- leverage Australia's knowledge and experience in cutting-edge research
- set, co-ordinate and achieve long-term multi-disciplinary research programs, focussing on the complex biological, technological, economic and societal needs of agriculture, industry and regional communities
- be a platform for transformative, over-the-horizon research and development to prepare Australian cropping for 2030, 2050 and beyond.

To increase agricultural production successfully and sustainably despite many constraints, Australian science must be enabled to develop a plethora of innovations: from revolutionary technologies to unimagined pest controls, from new leaps in soil science to highly resilient hyper-yielding crop varieties. There is a need for: novel methods to effectively manage agricultural data; new systems to support farmers; and, additional tools to transform productivity. More significantly, the technology should be informed, appraised and evolved as a collaborative endeavour between social, regulatory and policy researchers as well as scientists. To ensure fit-for-purpose and there is ethical and governance oversight.

The *National Mission* would advance research efficiency by facilitating information-sharing between project groups and minimising research duplication. Thus, capitalising on the enormous value of problem-solving across sectors, organisations, disciplines and fields of expertise. It is designed to:

- support the disruptive advances for addressing the challenges of profound population, climate, technological and economic change

- establish a single, longitudinal investment program, providing funding continuity needed for research organisations to collaboratively commit and deliver game-changing progress in agriculture.

The *National Mission* aims to:

- support a six-fold increase in year-on-year agricultural productivity through investments to increase the yield potential and climate resilience of major crop and pasture species, while reducing the relative input costs
- provide farmers with new tools to align their outputs to climate and market demand, including options to plant high-value alternative commodities to suit market and growing conditions
- ensure farmers have access to reliable, interpretable data and decision-making tools to confidently manage plant, crop, farm and value-chain variables
- build transformative readiness and capacity across the innovation ecosystem at grower, farm, region, sector and national facility levels.

Cropping underpins our agriculture sector. Australia is a leading producer of the world's most significant grains, and among the top exporters of wheat, barley, canola, chickpeas, lupins and oats. However, cropping is also critical to livestock production through fodder, feed-grade grain, sown pasture and mixed farming systems. Investment in over-horizon-research to ensure the sustainability of crop production in the face of climate change, population growth and economic headwinds is critical to the sector. The National Mission could deliver various positive outcomes for the agriculture in >10 years (Box 1).

- Grain crops can be switched from seed starch to leaf oil in mid-season
- Nitrogen-fixing wheat using <80% applied N fertiliser
- Water-efficient crops yield a profit in semi-arid Australia
- Using plants to improve soil health
- Using satellite technology to better manage grazing pastures
- Developing traceability systems for increased sustainability, market access and market value
- Training 10,000 new rural technology workers

Box 1: The National Mission - What might be delivered in >10 years?

### Recommendation

The FDF considers including industrial strategies to drive transformative adaption to climate change (eg. National Mission example supplied).

## Conclusion

We reiterate the university sector holds a central place in the innovation system to drive realisation of FDF goals. We agree with the Productivity Commission's assessment that targeted programs addressing specific gaps are appropriate and will generate the best value for investment. We hope these comments help in your deliberations and would be happy to provide further comments if required.



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