



WA Agricultural Research Collaboration

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Capacity needs analysis for the Western Australian agricultural research, development and extension sector: Sector-wide survey

May 2026

By Jane Wightman Consulting for the WA Agricultural Research Collaboration

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Primary Industries and
Regional Development



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1. Executive summary

This sector-wide survey forms the key component of a capacity needs/gap analysis (Needs Analysis) commissioned by the WA Agricultural Research Collaboration (WAARC) to identify and validate current and future human capacity requirements for Western Australia's (WA's) agricultural research, development and extension (RD&E) sector. The survey and analysis were undertaken independently by Jane Wightman Consulting.

Survey responses reveal a workforce that is skilled and committed but under increasing structural strain. Across more than 90 cross-discipline, middle to senior management respondents, a consistent message emerged: WA's agricultural innovation depends as much on people and capacity systems as on technical research.

Extension and communication, data and digital capacity, agronomy, climate adaptation, and systems integration were repeatedly identified as the disciplines most in need of investment. The analysis also shows that without intervention, capacity in critical areas will continue to decline as senior experts retire, and recruitment pipelines remain thin.

Mentoring and workforce development surfaced as the single most important enabler, highlighting the urgency of structured career pathways, leadership development, and succession planning. Respondents emphasised that attraction and retention challenges are rooted in insecure funding, uncompetitive salaries, weak career structures, and ageing infrastructure. Effective solutions therefore extend beyond training to institutional renewal, permanent roles, multi-year funding, modern research facilities, regional housing and employment support, and inclusive workplace cultures.

Diversity and inclusion are improving but remain uneven, requiring stronger leadership commitment and culturally capable organisational practice.

Across all findings, a coherent vision emerges for WA's RD&E future, a digitally capable, extension-literate, climate-ready, and inclusive workforce supported by mentoring, modern infrastructure, and cross institutional collaboration.

2. Foreword

The WA Agricultural Research Collaboration (WAARC) is Western Australia's (WA's) platform for collaborative agricultural research and development, bringing together government, universities, and industry to address key challenges such as climate resilience, productivity, sustainability, and biosecurity. Through its "Team WA" approach, WAARC drives practical, industry-led research that maximises impact while building capacity and strengthening the State's future agricultural workforce.

In August 2025, WAARC commissioned a capacity needs/gap analysis (Needs Analysis) to identify and validate WA's current and future human capacity requirements in the agricultural research, development and extension (RD&E) sector. This work is intended to guide WAARC and others in planning and investment to equip the sector with the expertise, skills and workforce structure to meet emerging challenges over the next 5 to 15 years. The work is a point in time stocktake, conducted by Queensland-based Jane Wightman Consulting.

Five reports relating to the Needs Analysis are now publicly available (May 2026):

1. Capacity needs analysis for the WA agricultural RD&E sector: Summary report
2. Capacity needs analysis for the WA agricultural RD&E sector: Literature review
3. Capacity needs analysis for the WA agricultural RD&E sector: Sector-wide survey **(this report)**
4. Capacity needs analysis for the WA agricultural RD&E sector: Interviews (Workforce pipeline and early career attraction)
5. Capacity needs analysis for the WA agricultural RD&E sector: Interviews (Data, digital and modelling)

Apart from the Summary report, these reports reflect the chronological flow of the study, which began in August 2025 and was completed in December 2025. The reports should not be considered independently of each other, but as a part of a package.

The aim of the Literature review was to ascertain what evidence was already available about needs/gaps in human capacity in the sector for WA, and to use this information to guide the structure and questions for the survey. The sector-wide online survey was the key data collection mechanism for the Needs Analysis, with 92 respondents from middle/senior manager, cross-discipline positions across the WA agricultural RD&E sector. Two focused interview topics were then selected from survey findings, with 15 interviews conducted. The Summary report brings together an overview of the findings from the suite of reports.

At each key step in the Needs Analysis process, feedback and validation were sought from a Strategic Advisory Group, comprised of senior and middle managers from key organisations and businesses across the agricultural RD&E sector.

By the WA Agricultural Research Collaboration, May 2026

3. Introduction

This sector-wide online survey is the second stage of the Needs Analysis, following the literature review by Jane Wightman Consulting and input from the Strategic Advisory Group.

The survey represents the key data collection mechanism for the Needs Analysis, seeking perspectives from a broad cross-section of WA agricultural RD&E stakeholders on three core questions:

1. What is the current capacity of WA's agricultural RD&E workforce?
2. Where are the most critical gaps and risks?
3. What initiatives or investments are most needed to strengthen capacity and retention?

Please note some sections and elements of the original cross-sector survey report by Jane Wightman Consulting have been removed or re-formatted to:

- *Enhance clarity of the key survey findings*
- *Reduce repetition with WAARC's Foreword, which is included for consistency and context across the suite of Needs Analysis reports.*

4. Methodology

Survey targets

The online survey was sent to a broad range of stakeholder groups in the Western Australian agricultural RD&E sector. This included stakeholders from WA universities (Curtin University, Murdoch University, The University of Western Australia and Edith Cowan University), Department of Primary Industries and Regional Development (DPIRD), CSIRO, Grower Group Alliance, grower groups, industry bodies (GRDC, MLA, GIWA, Cotton RDC, Hort Innovation, Wine Australia, AgriFutures Australia, WALRC), corporate agri-sector (AAAC, private consultants, Elders, Nutrien, Craig Mostyn, other corporate farming businesses), specialist providers (Living Farm, InterGrain, AGT), some NRM Groups and others.

The targets in these organisations were specifically middle to senior management roles and others known to have cross-discipline and/or cross-sector experience. Single discipline area experience was deliberately not sought. This was because we were looking for relative capacity need priorities across the sector rather than single discipline perspective needs. Inherent in this

approach is that the survey results are generated from the subjective perspective of each respondent. The survey was sent to around 125 targets and 92 responses were received.

Data analysis

Analysis of the survey data combined quantitative and qualitative methods, supported by two AI tools. Alchemer housed the online survey and collected raw data, while ChatGPT Plus assisted in analysing de-identified responses to identify key themes and capacity relationships. All AI assisted outputs were reviewed and validated by the project lead, ensuring analytical rigour and contextual accuracy.

This hybrid approach, combining human expertise with AI enabled text analysis, enabled systematic identification of key themes, validation of quantitative trends with qualitative insights, and the development of an integrated understanding of WA's current and emerging RD&E capacity needs.

Note on data interpretation

The capacity heat map (page 19-21), future gap predictions (page 23-24), overall priorities for building RD&E capacity in WA (pages 29-30), succession risk matrix (page 52-54), and capacity trajectories for the top three disciplines (page 70) have been developed solely from survey findings provided by the survey respondents. These analyses are intended as indicative guidance rather than definitive measures and should be used as discussion tools to stimulate conversation and prioritisation. As the survey data reflect respondents' perceptions and professional judgements, they represent subjective rather than objective evidence of capacity status or future workforce trends.

Note on terminology

Throughout this report, the term 'capacity' is used and is intended to encompass, the skills, knowledge, and competencies of individuals and the overall resources, systems, and workforce depth that enable delivery. This use of the word capacity reflects how stakeholders commonly describe workforce strengths and gaps across the RD&E system.

Acknowledgment

The project lead extends sincere thanks to all individuals and organisations who participated in the Needs Analysis survey. Your time, insights, and thoughtful contributions have been invaluable in helping to build a clearer understanding of Western Australia's current and future RD&E workforce needs. The perspectives shared through the survey have provided essential evidence to guide future investment, collaboration, and capacity development across the sector.

5. Who responded?

The survey was sent to around 125 targets and 92 responses were received. This section presents information about respondent's current role, organisation type, industry represented, discipline represented, years of experience in the agricultural RD&E sector and location.

Current role of respondents

The current roles of the 92 survey respondents are presented in Table 1 below, with the most common roles being R&D Manager, Chief Executive Officer / Executive Officer and Research Scientist.

Please note that as respondents were only able to tick one option, they have selected the option they feel best describes their current role. This may have resulted in some groups seeming to be more under-represented than expected; a 'R&D Manager' for example may also be a Research Scientist, and an 'Academic' highly likely to also be a 'Research Scientist'.

'Other' included Soil Commissioner, Senior Project Officer, Subject Matter Expert, Industry Body Chair, Research Association Representative, Innovation and Partnerships Representative, plant breeder, commercialisation manager, a grower/director, and a GRDC Western Panel member.

Table 1. Current role of respondents

Current role	Percentage	Number
R&D Manager	32	29
Chief Executive Officer / Executive Officer	20	18
Research Scientist	14	13
Extension / Industry development	5	5
General Manager	5	5
Consultant	4	4
Academic	3	3
Extension manager	2	2
Other	14	13
Total		92

Respondent organisation type

The organisation types for the 92 survey respondents are presented in Table 2 below, with the top five being DPIRD, universities, grower groups, CSIRO and the private sector.

'Other' included NRM groups, Department of Biodiversity, Conservation and Attractions (DBCA), Statutory Body, Agricultural Produce Commission (APC), research collaboration, WAARC, Co-op, Rangeland Biosecurity Association) and others. 'University' included Curtin, Murdoch, UWA, Edith Cowan.

Table 2. Respondent Organisation Type

Organisation type	Percentage	Number
DPIRD	20	18
University	15	14
Grower group	13	12
CSIRO	12	11
Private sector	12	11
Research and Development Corporation (RDC)	7	6
Industry body	4	4
Grower Group Alliance	3	3
Other	14	13
Total		92

Industries represented by respondents

Industries represented by the 92 survey respondents are presented in Table 3 below, with the top six being Broadacre grains, Farming systems, Horticulture, Broadacre pastures, Broadacre livestock and Pastoral livestock.

For this question respondents could tick 'all that apply', and the number of mentions for each industry was recorded. The total number of industry mentions was 241 across the 92 respondents.

'Other' included Apiculture, Cotton, Bushfood industries and Indigenous land and sea management. It also included the following disciplines, which may indicate these respondents work across agricultural industries, Aboriginal economic development, biosecurity, digital agriculture, ecological restoration, environment, nature, carbon, Indigenous landscape restoration, intensive agriculture, water science, Noongar restoration and food production, post-

farm-gate, pastoral leases and Unallocated Crown Land (UCL), Regional Drought Resilience Planning Program (RDRP), and the Soil Conservation Act (SCA).

Table 3. Industries represented by respondents

Industry	Percentage	Number of mentions across 92 respondents
Broadacre grains	23	56
Farming systems	17	41
Horticulture	12	29
Broadacre pastures	12	28
Broadacre livestock	11	27
Pastoral livestock	8	20
Viticulture	5	11
Aquaculture	3	7
Other	9	22
Total		241

Disciplines represented by respondents

Disciplines represented by the 92 survey respondents are presented in Table 4 below, with the top nine being Farming systems, Agronomy, Extension, Crop science, Crop physiology, Plant genetics and breeding, Soil science, Biosecurity and pest management and Animal science.

For this question respondents could tick 'all that apply', and the number of mentions for each industry was recorded. The total number of industry mentions was 251 across the 92 respondents.

Disciplines with only one mention were grouped into 'Other' for Table 4, and included Ag biotechnology, Biodiversity & One-Health, Commercialisation, Community development, Consultant (non-researcher), Drought physiology & phytoestrogens, Environmental science & natural resource management, Evaluation, Farm water, Finance, Hydrology, Innovation Molecular Biology & Biology, Operational management and Project management. Animal genetics and breeding was also grouped into 'Other' with two mentions.

Table 4. Disciplines represented by respondents

Discipline	Percentage	Mentions
Farming systems	10	26
Agronomy	10	25
Extension	8	21
Crop science	8	21
Crop physiology	7	17
Plant genetics & breeding	6	14
Soil science	5	13
Biosecurity & pest management	5	13
Animal science	4	11
Modelling	4	9
AI, robotics & ag tech	4	9
Plant pathology	3	8
Data science	3	7
Climate	3	7
Economics	2	6
Trade, policy & risk analysis	2	6
Behavioral & social sciences and impact	2	5
Market access	2	4
Market & consumer intelligence	2	4
Animal physiology	2	4
Statistics	2	4
Other (15 with 1 mention, 1 with 2 mentions)	6	17
Total		251

Respondent years of experience

Respondent's years of experience in agricultural RD&E is as follows:

- Greater than 30 years (25%)
- 21-30 years (26%)
- 11-20 years (22%)
- 6-10 years (11%)
- 0-5 years (15%)

Location of respondents

The location of survey respondents is as follows:

- Perth metropolitan area (61%)
- Regional Western Australia (34%)
- Rest of Australia (5%)

6. RD&E capacity priorities for WA

6.1 Human capacity priorities for the WA agricultural RD&E sector in next 5-15 years

Survey question: What do you consider to be the top three human capacity priorities required to support WA's agricultural RD&E sector over the next 5 to 15 years? By 'human capacity priorities,' we mean the most critical people related disciplines, roles, skill sets and capabilities, needed to meet future challenges. (Open text)

Human capacity, or workforce priorities required to support WA's agricultural RD&E sector over the next 5 to 15 years are presented in Table 5 below, ranked in priority order, with 1 being of highest priority.

Table 5. Human capacity priorities required to support WA's agricultural RD&E sector over the next 5 to 15 years

Rank	Theme	Percentage	Count (n)
1	Extension and communication	15	52
2	Data, digital and modelling	14	48
3	Agronomy and production systems	12	40
4	Climate and sustainability	8	28
5	Soil, water and biogeochemical systems	7	22*
6	Analytics and statistics	4	14
7	Mentoring and workforce development	4	12
8	Systems thinking and innovation	4	12
9	Collaboration and leadership	2	8
10	Behavioural and social science	2	6
11	Postharvest and quality	1	4
12	Other / Unclassified	27	89
	Total		335

Priority 1 - Extension and communication

This analysis highlights that Extension and communication (n=52, 15%) is the most frequently cited human capacity priority, reflecting strong, cross-sector demand for professionals who can translate science into practice. Respondents emphasised that effective communication and behavioural understanding are core competencies, not optional skills.

One respondent noted, 'We need people who can communicate science clearly to growers.' Another commented, 'Extension capacity and co-design skills are essential to get adoption happening on farm.' Others reinforced this message, highlighting that 'Ability to work and lead multi-discipline across science and industry, real communication skills are rare,' and that 'Behavioural and social science for change and adoption, we need people who understand how and why farmers make decisions.' A further respondent added that 'Mentoring for researchers and extension officers so communication and facilitation skills are embedded early in their careers' will be critical to rebuild capability and ensure lasting impact.

Priority 2 - Data and digital capacity

Data, modelling & digital (n=48, 14%) runs a close second priority, reflecting strong demand for professionals who can leverage data and digital tools for RD&E innovation. Respondents consistently described data and digital capacity as fundamental to WA's RD&E future.

One explained, 'Upskilling in data analytics, modelling and AI is critical to support decision making.' Another emphasised that 'Data science and modelling capacity is fundamental, we are far behind other sectors,' while a third added that 'Data science in all its facets, particularly analytics and machine learning for on-farm decision support, is now essential.' Others noted that 'More capability in data modelling and analysis is needed to connect research outputs with real-time decision making,' underscoring the urgency of embedding digital literacy and analytical skills across the entire RD&E workforce.

Priority 3 - Agronomy and production systems

Agronomy and production systems (n=40, 12%) also ranks highly, reinforcing the need for applied, field-based expertise that integrates production, profitability, and sustainability.

As one respondent observed, 'We need more applied agronomists who can adapt research to local systems,' and another highlighted, 'Support for farming systems research and practical agronomy training is important for the next generation.' Additional comments echoed this, noting that 'Cereal agronomy remains the backbone of WA agriculture but is losing trained people,' and that 'More people who understand how research translates into on-farm management and production systems' are essential to bridge the gap between research outputs and practice in diverse farming environments.

Priority 4 - Climate and sustainability

Priority 5 - Soil, water and biogeochemical systems

Climate and sustainability (n=28, 8%) and Soil, water and biogeochemical systems (n=22, 7%) both featured prominently, showing recognition of environmental resilience and natural resource management challenges. A participant stated, 'Climate resilience and adaptation research needs to be better embedded in projects,' while another said, 'Capacity to measure and manage emissions is becoming vital.' Respondents further emphasised that 'Climate adaptation extension — we need specialists who can turn modelling into practical options for growers,' and that 'There's an ongoing and critical need to attract people into sustainability, carbon and environmental markets work.' In the soil and water space, one respondent noted, 'Soil science and water management skills are critical for sustainable farming.'

Other

Lower ranked but still significant areas include:

- Analytics and statistics (n=14, 4%) - 'We need more biometric and statistical support for research projects.'
- Mentoring and workforce development (n=12, 4%) - 'More mentoring and coaching opportunities for early career staff.'
- Systems thinking and innovation (n=12, 4%) – 'We need systems thinkers who can integrate across disciplines.'

Mentioned less frequently but still relevant niche priorities include Collaboration & Leadership (n=8, 2%), Behavioural & Social Science (n=6, 2%), and Postharvest & Quality (n=4, 1%).

The large 'Other / Unclassified' category (n=89, 27%) included general or multi topic comments that were broad in nature for example, 'Research capacity,' 'Skills development,' and 'Capacity building.' These highlight widespread recognition of workforce challenges but without specifying particular technical disciplines.

6.2 Priority areas for professional development and upskilling

Survey question: What do you consider to be the top three priority areas for professional development and upskilling in agricultural RD&E to help meet the future needs of WA's agricultural RD&E sector? For each area, please indicate the career stage(s) where you believe this is most needed (e.g. early-career, mid-career, senior). (Open text)

Priority areas for professional development and upskilling in agricultural RD&E in WA are presented in Table 6 below, ranked in priority order, with 1 being of highest priority.

Table 6. Priority areas for WA's agricultural RD&E workforce professional development and upskilling

Rank	Theme	Percentage	Count (n)
1	Mentoring and workforce development	33	115
2	Extension and communication	12	44
3	Data, digital and modelling	11	40
4	Collaboration and leadership	7	24
5	Agronomy and production systems	5	19
6	Systems thinking and innovation	4	15
7	Climate and sustainability	4	13
8	Analytics and statistics	3	11
9	Soil, water and biogeochemical systems	3	9
10	Behavioural and social science	2	6
11	Postharvest and quality	2	6
12	Other / Unclassified	14	51
	Total		353

Priority 1 - Mentoring and workforce development

The analysis of professional development (PD) and upskilling priorities shows that Mentoring and workforce development (n=115, 33%) overwhelmingly dominates the discussion. Respondents frequently identified the need for structured mentoring, coaching and capacity development programs, particularly for early and mid-career professionals. One respondent noted, 'We need mentoring and training for early career staff to build confidence and retain talent in regional areas,' while another added, 'Succession planning and on-the-job coaching should be built into projects, not left to chance.'

Priority 2 – Extension and communication

Extension and communication (n=44, 12%) was the next most common area of focus. Participants consistently emphasised the importance of improving the way research is shared and applied. As one respondent said, 'We need stronger communication and engagement capacity to ensure science reaches farmers,' while another commented, 'Training in facilitation and co-design would help improve adoption outcomes.' Respondents also stressed that 'Extension methods and modern information delivery - particularly for early and mid-career staff - are most needed,' and that 'Extension skills across both crop and livestock sectors need structured professional development to build confidence and consistency in delivery.'

Priority 3 – Data, digital and modelling

Data, digital and modelling (n=40, 11%) followed closely, reflecting the sector's growing reliance on digital literacy and analytical capacity. Respondents frequently called for improved data skills, with one stating, 'Upskilling in data analysis, modelling and digital tools is now essential,' and another observing, 'There's a real need for training in data interpretation and integration across projects.' Further comments reinforced that 'Automation, image analysis, data science and AI literacy are becoming essential baseline skills for early-career professionals,' and that 'Training PhD students to conduct agricultural data collection and interpretation using digital tools' will help bridge capability gaps in future RD&E.

Priority 4 – Collaboration and leadership

Collaboration and leadership (n=24, 7%) was also seen as a priority, highlighting the demand for professionals who can lead teams and foster partnerships across organisations. One participant commented, 'Leadership and teamwork training should be part of every RD&E role,' while another noted, 'We need more opportunities for people to develop collaborative leadership skills.' Others echoed this, stating that 'Mentorship and developing early-career leadership capability should be a core part of every program,' and that 'People capability - working with people, knowledge sharing and leading teams - are as critical as technical expertise.'

Priority 5 – Agronomy and production systems

Agronomy and production systems (n=19, 5%) remained a key technical upskilling area, with respondents highlighting the need for field-based research capacity and practical agronomic skills. One respondent explained, 'Upskilling in practical agronomy is needed for new

researchers,' while another said, 'We need more training in systems approaches to crop and pasture production.' Additional comments reinforced this theme, emphasising that 'Understanding farming systems - especially for early to mid-career staff - is vital to strengthen how production systems integrate,' and that 'Practical agronomy and extension skills across crops and pastures should be core early-career training.'

Priority 6 – Systems thinking and innovation

Systems thinking and innovation (n=15, 4%) also emerged as a recurring theme, with several respondents calling for the ability to integrate across technical and social disciplines. Comments included, 'We need more systems thinkers in agriculture,' and 'Innovation training that encourages people to think beyond their discipline would make a big difference.' Respondents also pointed to the need for 'International travel support which in turn fosters innovation and systems thinking by exposure to global practices,' and 'Building skills for researchers at all career stages in integrative and systems-based design approaches.'

Other

Climate & Sustainability (n=13, 4%) was cited as an important emerging skill area, with respondents recognising the increasing importance of adaptation, carbon management and environmental stewardship. One participant stated, 'We need training in climate adaptation and sustainability metrics,' while another added, 'Understanding emissions and environmental reporting is now essential.'

Analytics & Statistics (n=11, 3%) continued to be viewed as a cross cutting technical need. One respondent noted, 'Statistical and analytical skills underpin good science,' and another emphasised, 'We need more biometricians and evaluation capacity within teams.'

Although smaller in representation, **Soil, water and biogeochemical systems** (n=9, 3%) remained a specialised focus area. A participant commented, 'Soil and water management training needs to be ongoing,' while another added, 'Skills in hydrology and nutrient management are becoming increasingly important.'

Behavioural and social science (n=6, 2%) and **Postharvest and quality** (n=6, 2%) were less frequently mentioned but still relevant skill sets. One respondent highlighted, 'Behavioural science should be used more to support change programs,' while another stated, 'We need training in postharvest handling and quality assurance systems.'

Finally, **Other / Unclassified** (n=51, 14%) contained general or broad responses referring to skill development without specifying a discipline. Typical examples included 'Skills development for the future workforce' and 'Capacity building across the RD&E system.' These highlight a shared recognition of capacity needs but without pinpointing specific technical priorities.

6.3 Capacity and upskilling needs/gaps

Survey question: Please rate the current human capacity for researchers in WA across the following areas and whether the capacity and training/upskilling needs to change to support future agricultural RD&E in WA.

(Respondents were provided a list of options for future capacity needs, including an option for 'other'. For each of these options, respondent were asked to rate current capacity on a scale of 1-10, select from a dropdown whether capacity for each option needed to increase, decrease or stay the same, and select from a dropdown whether training/upskilling for each option needed to increase, decrease or stay the same There was also an optional comment box for each option.)

Overview of findings

Across WA's agricultural RD&E system, no area/discipline was viewed as over resourced, almost all respondents called for increases in both human capacity and training.

The most urgent priorities are Data and digital, Inter-disciplinary integration, Extension and adoption science, and Climate adaptation and environmental markets, all attracting near-unanimous support for expansion. These areas were seen as foundational for innovation, resilience, and productivity, yet current capacity is low to moderate and heavily fragmented.

Respondents repeatedly emphasised that cross-disciplinary and human capacity development, not just technical research, is essential for system-wide impact. Several used emphatic language such as 'critical,' 'desperately needed,' and 'major priority' to underscore the urgency of capacity renewal. Investment in training and workforce development was seen as pivotal to rebuilding WA's RD&E strength and ensuring the State can both manage risk and seize emerging opportunities in data driven, climate resilient, market connected agriculture.

Capacity heat map

A heat map of WA agricultural RD&E capacity developed from respondent's feedback is presented in Table 7 below. The table summarises how WA's agricultural RD&E disciplines compare in current capacity (1–10 scale) and the proportion of respondents wanting capacity and training increased, expressed through calculated gap indices. Higher gap indices indicate stronger perceived deficiencies and higher investment urgency.

Table 7. WA agricultural RD&E capacity heat map*

Discipline	Current Capacity 1–10**	% Want Capacity Increased	% Want Training Increased	Capacity Gap Index	Training Gap Index	Capacity Gap Index (norm)	Training Gap Index (norm)
Data and digital	4	96	96	5.76	5.76	1	1
Inter-disciplinary	5	96	94	4.8	4.7	0.83	0.82
Extension and adoption science	4	75	78	4.5	4.68	0.78	0.81
Climate adaptation and environmental markets	5	77	84	3.85	4.2	0.67	0.73
Biosecurity and market access	4	53	55	3.18	3.3	0.55	0.57
Indigenous knowledge and experience	6	67	68	2.68	2.72	0.47	0.47
Systems agronomy and farm engineering	6	63	69	2.52	2.76	0.44	0.48
Market and consumer Intelligence	5	46	48	2.3	2.4	0.4	0.42
Trade, policy and risk analysis	6	58	57	2.32	2.28	0.4	0.4
Water systems and irrigation	7	70	68	2.1	2.04	0.36	0.35
Genetics and breeding	6	38	40	1.52	1.6	0.26	0.28

*Capacity heat map method is in Appendix 1 **1=low capacity, 10= high capacity

Additional data for current human capacity and future training needs are provided in Appendix 2 (Figs 2, 3 and 4).

Capacity heat map interpretation

Critical priority gaps

Data and digital (CGI = 5.76; norm = 1.00), The most urgent deficit. Despite being fundamental to future agricultural innovation (AI, sensors, analytics, robotics), this area shows one of the lowest current capacity ratings (4/10) and near unanimous demand for growth (96%). Both capacity and training gaps are at their theoretical maximum, underscoring digital RD&E as WA's most constrained capacity.

Priority: Establish data and digital innovation pipelines, integrate analytics skills into agronomy, and build dedicated upskilling programs.

Inter-disciplinary capacity (CGI = 4.8; norm = 0.83). Also rated as critical, reflecting recognition that multi-disciplinary problem solving is essential for complex systems challenges. High demand for an increase in capacity (96%) and increase in training (94%). Respondents flagged insufficient people able to integrate biophysical, economic, and social dimensions across sectors.

Priority: Build cross-disciplinary project roles, fund systems thinking training, support integrator positions.

Extension and adoption science (CGI = 4.5; norm = 0.78). A high intensity gap reflecting long term under investment in extension capacity. Low base capacity (4/10) and high training demand (78 %) signal erosion of skills that connect research to practice.

Priority: Rebuild advisory networks, invest in communication, behaviour change and participatory methods training.

Moderate to high priority gaps

Climate adaptation and environmental markets (CGI = 3.85; norm = 0.67). Reflects increasing urgency to address climate resilience, carbon markets, and sustainability metrics. Although capacity is slightly stronger (5/10), 77–84 % of respondents want expansion and upskilling.

Priority: Strengthen adaptation modelling, MRV (Measurement, reporting, and verification) skills, and carbon accounting expertise.

Biosecurity and market access (CGI = 3.18; norm = 0.55). A moderate but strategically important gap. Existing teams perform well but face growing pressure from new pest incursions and export compliance.

Priority: Maintain surveillance, diagnostic, and risk analysis training pipelines.

Lower priority gaps

Indigenous knowledge and experience (CGI = 2.68; norm = 0.47). Mid-range capacity (6/10) yet 67–68 % still call for greater inclusion, co-research, and Indigenous leadership.

Priority: Co-design frameworks and two-way learning programs.

Systems agronomy and farm engineering (CGI = 2.52; norm = 0.44). Reasonable existing strength but ongoing need for integration with digital and climate systems.

Priority: Support next generation farm systems engineers and precision-ag integration.

Market & Consumer Intelligence (CGI = 2.30; norm = 0.40). Capacity judged moderate, demand growth reflects interest in consumer insights, value chains, and sustainability verification.

Priority: Build data analytics and market research links with agribusiness.

Trade, Policy & Risk Analysis (CGI = 2.32; norm = 0.40). Limited analytical capacity with a lack of local modelling capability, workforce succession gaps.

Priority: Economic modelling, trade analysis and compliance training.

Water Systems & Irrigation (CGI = 2.10; norm = 0.36). Rated 7/10 current capacity, indicating strength but recognition of new technology adoption needs (e.g., water-use efficiency, remote sensing).

Priority: Training in water use modelling, IoT monitoring and irrigation automation.

Genetics & Breeding (CGI = 1.52; norm = 0.26). The least critical gap. Strong existing research base and continuity from national investments. Training interest remains (40 %), suggesting a need for modernisation in genomic analytics rather than more staff.

Priority: Focus on bioinformatics, phenomics and cross-disciplinary collaboration.

Other responses

Respondents also cited systems ecology, behavioural science, bioeconomic modelling, soil biology, regenerative practices, pasture research, livestock production, and community/workforce development as areas of ‘dangerously low’ capacity. Respondents stressed that ‘agriculture can’t thrive without skilled people and healthy communities.’

Future gap predictions

Figure 1 compares current (baseline) capacity levels with projected outcomes at Year 10 under two scenarios, *no change* and *targeted investment*. It illustrates how focused investment could substantially lift capacity across most RD&E domains.

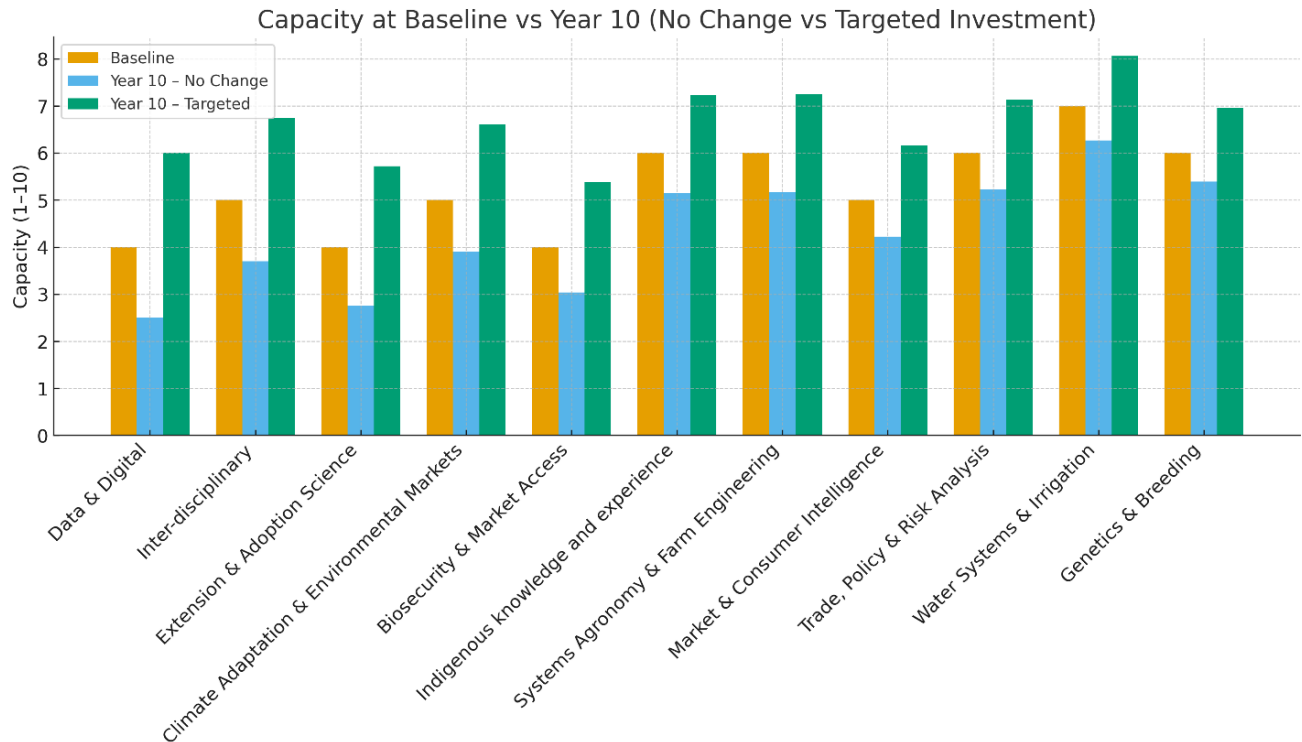


Figure 1. Future gap predictions

No change scenario

- Annual decline = $0.03 + 0.12 \times (\text{Capacity Gap Index norm})$ on the 1–10 scale.
- Rationale: ageing workforce, attrition and rising demand accelerate decline where the current gap is bigger.

Targeted investment scenario

- Years 1-5: annual improvement = $0.08 + 0.22 \times (\text{Training Gap Index norm})$.
- Years 6-15: annual improvement tapers to $0.03 + 0.07 \times (\text{Training Gap Index norm})$.
- A practical ceiling (asymptote) of 8.5/10 is applied to reflect real-world limits.
- Rationale: early program surge from recruitment and PD, then steady consolidation.

For both paths, Capacity Gap Index and Training Gap Index at 5/10/15 years using original demand percentages (kept constant for a conservative view).

Results

Without action, Data and digital and Extension and adoption continue to erode (to ~2.5–2.2/10 by Year 15), widening deficits.

With targeted investment, Data and digital climbs toward ~6.5/10 by Year 15; Extension and adoption to ~6.1; Inter-disciplinary to ~7.2 is enough to flip the narrative in all three.

Stable areas (Genetics and breeding, Water systems) hold or improve modestly with investment, under status-quo they still drift down.

No change leads to broad capacity decline, steepest where gaps are already critical.

Targeted investment reverses trend lines within 2–3 years for top priority areas and reaches 6–7.5/10 by Year 10 across most of them, with the strongest lift in Data & Digital and Inter-disciplinary.

Annual improvement coefficients ($0.08 + 0.22 \times \text{TGI}$ in years 1–5; $0.03 + 0.07 \times \text{TGI}$ in years 6–15) were selected to reflect empirically observed rates of capacity recovery from major RD&E capacity building programs (CSIRO 2020, GRDC 2025, OECD 2023, UKRI 2021, UNESCO 2021). They produce early phase gains of ~1–1.5 points on a 10-point scale over five years, consistent with workforce development benchmarks, followed by a realistic taper as systems stabilise.

Further information on the methodology for derivation of decline and improvement coefficients can be found in Appendix 3. Capacity trajectories for the top 3 disciplines are presented in Appendix 4.

6.4 Technical and extension support

Survey question: In your view, what types of technical support and extension roles and skills are most needed to strengthen agricultural RD&E capacity in WA? Please outline any areas where you believe additional technical or extension capacity would have a meaningful impact. (Open text for each.)

Technical support roles and skills most needed

For technical support, the heaviest signals were for:

- Technical training (101)
- Data, modelling and digital
- Field-ready agronomy/systems (including technicians/contractors for trials)

With a meaningful secondary signal for soil/water/natural resources and postharvest/quality.

Workforce and training infrastructure (technicians/contractors)

Shortages in the applied technical workforce and foundational training were repeatedly raised. ‘101 material and courses for a range of topics’ and ‘Contractor/technician capacity for research trials’ were recurring comments. One respondent also noted that ‘Less about technical capacity but more about not removing strong technical expertise and placing them in management positions they may not want, and ensuring technical teams have administrative support so their focus stays on research.’ This feedback underscores the importance of valuing technical

specialists, maintaining clear career pathways, and providing the support structures that allow them to remain focused on research delivery.

Data, modelling and digital

Strong demand was expressed for digital capacity spanning analytics, imaging, integration, and decision-support. Respondents called out: 'Image-based analysis of crop, pasture and animal traits,' 'Effective interrogation of big data,' 'Ag data integration specialists... able to interpret data coming from LLMs and many sources,' and simply 'Everything digital.' These comments highlight the need for professionals who can connect digital technologies with practical application in the field, ensuring that modelling and data tools support real-world decision making.

Agronomy and production systems

Emphasis remains on practical, field-based capacity across crops, pastures, and on-farm experimentation. Examples included: 'Farming systems (not just crop rotations), livestock and forage production, hydrology, these skills are declining and will be needed to manage future challenges,' 'Need more capacity in contractors for seeding and harvesting research trials,' 'Technical expertise for running on-farm trials and delivering RD&E is in short supply,' and 'Pasture skills across southern Australia are very low.' Collectively, these comments reinforce that applied agronomy and systems capacity are critical to sustaining productivity and environmental performance.

Soil, water and natural resources

Requests for hydrology, environmental monitoring, and landscape scale capacity, often coupled with remote sensing. Respondents noted: 'Mapping and utilisation of multi-spectral... drones, imagery, soil types, diversity connectivity', and the need to 'Increase early to mid-career technical staff skilled in... robust data collection and practical translation of research'. The need for 'climate and nature scenario analysis' was also highlighted.

Postharvest & quality

Targeted but repeated mentions of product integrity and post farm gate capacity: 'Postharvest, produce quality, technology'.

On-ground-ready tools & usability

A smaller but clear signal to build tools that work 'on the ground', 'Develop tools that are very efficient and easy for use by farmers' and 'Technical advisory services for adopting climate smart practices... using tools to reach stations and communities across vast distances.'

Extension support roles and skills most needed

For extension support, the strongest signals were for Extension and communication practice and Extension workforce development, followed by Systems agronomy and mixed-farming advice, Participatory R&D, and Digital extension.

Extension and communication practice (most frequent)

Core extension capacity, communication, facilitation, adult learning, co-design, were the top asks. Typical phrases: 'Consistent training programs for early and mid-career researchers in the principles of adult learning and extension', 'Embedded within research, co-design and partnership throughout', and 'Train the trainers.' 'Decision support and resource use trade-off [skills]' were also included as important for those working in extension.

Workforce development for extension

A clear call for structured PD, credentials and career paths in extension: 'There's a shortage of experienced extension professionals who can effectively connect science to practice. Bridging this gap is essential to improve adoption rates and on farm impact.' 'Identify early-career staff with great communication skills', and 'Extension training to be a key component of graduate training'.

Systems agronomy and mixed-farming advice

Respondents want extension staff fluent in mixed systems and practical management: 'More consultants that understand mixed farming systems', 'Cross-disciplinary systems extension professionals able to integrate across climate, economics, and production systems, helping growers apply whole of farm solutions. And Cultural capacity, extension roles with Indigenous engagement expertise to strengthen First Nations participation in agricultural R&D.'

On-farm participatory R&D

Stronger farmer researcher partnership models and joint experimentation: 'Models for farmer collaboration in R&D' and 'More participatory experiments between farmers and researchers'.

Digital extension

Using data and digital tools within extension practice: 'Extension is lacking in digital', 'Being capable of translating and communicating vast amounts of data for application/extension', and 'Data analytics and extension' roles.

6.5 Other supporting roles

Survey question: What other roles support RD&E in WA, what do they contribute and are there any gaps? e.g., volunteers assist in identifying R&D needs, support implementation of research in the field, host on farm trials. (Open text).

Respondents clearly see that RD&E in WA depends on a broad network of supporting roles beyond researchers, including volunteers, growers, grower groups, agribusiness, NGOs, education providers, government, and Indigenous land managers. These contributions are essential, but the system is held back by fragmentation, under-resourcing, lack of formal coordination, and over reliance on unpaid contributions. Strengthening coordination, recognition, and workforce capacity were recurring themes in the feedback.

Volunteers and growers

Many respondents highlighted the critical role of volunteers and growers in supporting RD&E in Western Australia. Growers host on-farm trials, provide sites for field days, supply equipment, and contribute their practical knowledge to help shape research priorities. Volunteers are also heavily involved in 'project design, steering committees, grant writing, capturing measurements, extending information, hosting and managing trials.' Several noted that this contribution is undervalued, with one respondent stating, 'Growers and volunteers... contribution is undervalued and reliant on goodwill, which risks burnout.' Others reinforced the centrality of applied agronomy, noting that 'Field experiment hosts are critically important, without growers who host on-farm trials there would be no applied research.' Concerns were raised about the sustainability of this, as another respondent explained, 'Huge reliance on volunteers. Difficult to see that being sustainable as number of farms continues to decline.'

Grower groups and community organisations

Grower groups and community organisations were also identified as essential to RD&E were also identified as essential to RD&E delivery. They coordinate trials, manage logistics, support extension events, and provide trusted linkages between researchers and farmers. Respondents recognised these groups as key to intelligence gathering and priority setting, 'Lots of regional and industry support groups (e.g. grower groups, NRM groups) contribute to strategic planning and are great sources of farmer intel regarding current challenges and opportunities.' However, several respondents flagged that many grower groups face funding insecurity and uneven regional coverage, making it difficult to provide consistent, long-term support. One noted the need to 'support voluntary Grower Group Committees (in governance and employee management) to ensure their employees and volunteers are managed well and safely.'

Agribusiness and private sector partners

Agribusiness and private sector partners also play a valuable role in supplying machinery, also play a valuable role in supplying machinery, technical services, and practical expertise that ensure research remains relevant to farming systems. These actors often help translate research into practice and provide feedback loops to researchers. Yet respondents expressed frustration with a lack of coordination: 'Too many organisations / barriers between the researcher and end users. Too many generalised messages.' And 'Better coordinated R&D driven by industry, managed regionally and shared nationally would deliver greater impact.' This gap reflects a broader theme of fragmented RD&E efforts across the state.

Education and training providers

Education and training providers, including schools, universities, and training organisations, including schools, universities, and training organisations, contribute through student placements, early-career workforce development, and technical support for field trials. They play an important role in building future workforce pipelines. However, respondents observed a 'decline in experimental field skills across crops and pastures' and called for 'more structured career pipelines into regional WA' to ensure skilled staff are retained in the sector. One participant also emphasised that 'Education and teaching in universities are essential to

maintain the RD&E pipeline, yet they are often undervalued,' reinforcing the importance of sustained investment in tertiary training and academic–industry linkages to secure the next generation of RD&E professionals.

Policy, regulatory, NRM, and local government

Policy, regulatory, NRM, and local government actors also contribute by supporting infrastructure, embedding research in regional planning, and aligning research with compliance and environmental frameworks. Their potential is not fully realised, however, with several respondents noting they are 'often overlooked as potential collaborators in extension and local trials' and that stronger alignment with agricultural priorities could enhance their impact. One participant noted that 'funding policies affect the ability to leverage funds from other sources to the detriment of recruiting and retaining staff.'

Boundary-spanning and systems-oriented roles

Respondents highlighted the need for boundary spanners, people who connect research, extension, and practice across sectors, disciplines, and scales. These individuals can operate locally, nationally, and internationally to bring in new ideas, partnerships, and resources. One respondent noted that 'Boundary spanners, those that are focussed on building connections between researchers, growers and industry are critical but under-resourced.' Systemic gaps were identified, including fragmented coordination, weak feedback loops, short-term funding, and declining specialist and facilitation capacity. As another participant observed, 'Better collaboration and interaction of all agribusiness/research/farmers that are involved in research not currently happening.'

Participants called for skilled operators and connectors (Innovation Brokers) who can work with producers to identify RD&E needs and champion them for investment, as well as systems-oriented roles that bridge agricultural research with mining, environmental management, community development, and Indigenous knowledge. Collectively, these roles were seen as essential to creating a more integrated and outward-facing RD&E system for WA.

Under-utilised Indigenous knowledge and underrepresented groups

Respondents recognised that Indigenous land managers contribute unique cultural knowledge and perspectives on sustainable land management. However, there are currently 'underdeveloped engagement frameworks and funding' to ensure these perspectives are integrated meaningfully into RD&E.

Skilled operators to run on farm trials

There is 'a great need for skilled operators to run on farm trials,' reflecting both the practical demands of conducting high quality field research and the shortage of trained technical staff to do so. This point reinforces earlier feedback around declining experimental field skills and the need for structured training pathways in regional WA.

6.6 Overall priorities for building RD&E capacity

Overall priorities

The following three sections of the survey were reanalysed together to come up with overall priorities for building RD&E capacity in WA:

Section 6.1 - Human capacity priorities (5–15 years)

Section 6.2 - Professional development and upskilling priorities

Section 6.3 - Capacity and training/upskilling needs

The overall top priorities converge on a single message: WA's RD&E system must build a digitally capable, extension literate, systems-oriented, and sustainability ready workforce, supported by structured mentoring and collaboration across institutions.

Responses in relation to technical, extension and volunteers add a layer of operational insight, showing that capacity shortages are not only in specialist expertise but also in the technical and delivery infrastructure that enables RD&E to reach the ground. Repeated concern about reliance on volunteers, grower groups dwindling resources and lack of coordination between all the RD&E entities working in agriculture.

Five themes repeatedly emerge across all three datasets:

1. Extension and communication
2. Data and digital
3. Systems/interdisciplinary capacity
4. Climate and sustainability
5. Agronomy and production systems.

See Table 8 for summary comparison of highest capacity and training/upskilling priorities and needs across the three datasets.

Table 8. Comparison of highest priority capacity and training/upskilling needs across three datasets

Theme / capacity area	Human capacity priorities (5–15 yrs) *	Professional development & upskilling priorities*	Capacity & training needs**	Observations on similarity
Data, modelling and digital	#2 (19 %)	#3 (19 %)	#1 (96/96 % want ↑)	Universally recognised as <i>critical and under-resourced</i> . Consistent message about weak data governance, analytics, and applied AI skills.

Extension and communication / adoption science	#1 (20 %)	#2 (21 %)	#3 (75/78 % want ↑)	Strongest continuity across all sections. The system views extension as <i>core infrastructure</i> linking research to adoption, not a peripheral activity.
Agronomy and production systems / Systems agronomy	#3 (15 %)	#5 (9 %)	#6 (63/69 % want ↑)	Consistently mid to high priority, reinforcing the need for <i>applied, field-based skills</i> and systems integration on-farm.
Climate adaptation and sustainability	#4 (11 %)	#7 (6 %)	#4 (77/84 % want ↑)	Recur across all sections but with varying strength. Recognised as <i>emerging but essential</i> , especially for carbon and environmental markets.
Mentoring and workforce development	#7 (5 %)	#1 (54 %)	Implicit (succession cited as gap)	PD responses elevate this theme far higher, showing a <i>people system shift</i> focus on developing and retaining talent, not just technical capacity.
Interdisciplinary / Systems Capacity	#8 (5 %)	#6 (7 %)	#2 (96/94% want ↑)	Gains salience in capacity analysis. Reflects recognition that innovation depends on <i>cross-disciplinary integration</i> (technical + social + economic).
Soil, water and biogeochemical systems	#5 (9 %)	#9 (4 %)	#7 (68/70 % want ↑)	Consistent but secondary. Seen as a specialised technical need underpinning sustainability.
Collaboration and leadership	#9 (3 %)	#4 (11 %)	Implicit in 'interdisciplinary capacity'	Highlighted more strongly in professional development context, linked to mentoring and teamwork.

*#1 is the highest priority

**#1 (96/96 % want ↑) = #1 is the highest priority, 96% of respondents indicated this area required greater capacity and 96% indicated training needs to be increased in this discipline.

Areas of similarity

Across all three sections, the following common findings stand out:

Digital capacity dominates

- Ranked in the top 3 across every section.
- Viewed as the most urgent and transformational gap for WA's RD&E system.
- Key needs: data governance, analytics, applied AI, IoT, and digital integration.

Extension and adoption capacity is central

- Top ranking (or near the top) across all sections.
- Respondents call for renewed investment in facilitation, communication, and behavioural science to connect research with practice.

System level integration and interdisciplinary capacity

- Repeatedly described as 'the ultimate need' or 'desperately required.'
- Siloed research cultures and limited collaboration hinder innovation; respondents want integrative, whole of system approaches.

Climate adaptation and sustainability

- Prominent in every section, highlighting the shift toward climate ready science, carbon literacy, and resilience skills.

Applied agronomy and production systems

- Consistently mid to high priority, reinforcing the need for applied, field-based skills and systems integration on-farm.

Consistent technical foundation.

- Signals the ongoing need for regionally embedded, field ready professionals to translate research into practice.

Emerging trends and insights

Convergence on human centred capacity

Across all sections, respondents emphasise *people, relationships, and translation* as much as technical expertise. Mentoring, leadership, and communication recur as enablers of system performance.

Digital and data literacy as a baseline skill

Data and digital now sits alongside agronomy and extension as a *foundational discipline* essential for every professional, not just specialists.

Integration over isolation

Strong momentum toward breaking disciplinary silos, linking technical, social, and economic perspectives for greater system impact.

Sustainability as a unifying driver

Climate adaptation, environmental markets, and soil/water management together represent a coherent sustainability skillset increasingly central to RD&E investment.

Renewal and succession urgency

The prominence of mentoring and workforce development underscores the demographic and institutional risk posed by ageing specialists and short-term contracts.

7. Attraction & retention of workforce

7.1 Barriers to attracting and retaining skilled people

Survey question: What are the biggest barriers to attracting and retaining skilled people in WA agricultural RD&E? (Respondents asked to rank a list of provided options, including an option for 'other', for both Attracting and Retaining.)

Overview

Across WA's agricultural RD&E system, salary competitiveness and job security emerged as the most significant barriers to both attracting and retaining skilled people. Respondents consistently highlighted that pay scales lag behind competing industries and that short term contracts and funding cycles create instability and limit career continuity.

Career progression, location, and awareness of agricultural RD&E careers followed closely, reflecting challenges in building visible and appealing long-term pathways, particularly for early career professionals and those based in regional areas. Infrastructure was seen as a persistent constraint, with ageing facilities and limited access to research resources undermining morale and research quality. While diversity and inclusion ranked lower, respondents stressed that culture and belonging are critical to long term retention.

Overall, the findings point to a system constrained by structural and cultural factors, where competitive remuneration, secure career pathways, and inclusive, well-resourced workplaces are essential to sustain and grow WA's RD&E workforce.

Tables 9 and 10 below present average rankings for barriers affecting attraction and retention of skilled people.

Table 9. Barriers to attracting skilled people

Barrier / Factor - Attracting	Average ranking*
Salary competitiveness	2.3
Job security	2.9
Lack of awareness of careers in agricultural RD&E	3.0
Career progression	3.5
Location	3.5
Infrastructure	4.9
Diversity and inclusion	6.0

**Ranking 1 to 7, where 1=highest priority*

Table 10. Barriers to retaining skilled people

Barrier / Enabler - Retaining	Average ranking*
Salary competitiveness	2.1
Job security	2.4
Career progression	2.6
Location	3.4
Infrastructure	4.2
Diversity & inclusion	5.5

**Ranking 1 to 6, where 1 = highest priority*

Salary competitiveness

Ranked first for both attracting and retaining

Salary competitiveness was consistently identified as a key challenge to attracting and retaining skilled staff in WA's agricultural RD&E system. Respondents highlighted that 'Agriculture R&D salaries are often lower than competing industries (e.g. mining, energy), making attraction difficult.' Many noted that the demanding nature of the work was not reflected in the level of remuneration, with one respondent commenting, 'It's hard work , why work so hard for less money than you can get cleaning on a mine site?'

The high cost of living in Western Australia was also cited as an additional deterrent, with one participant noting that 'WA is a difficult environment to attract/retain people with cost of living and wages on offer in other sectors.' Collectively, these perspectives suggest that improving pay structures and financial incentives could significantly enhance the sector's ability to attract and retain skilled professionals.

Feedback for retaining skilled staff was similar to that for attracting skilled people. In addition to these shared concerns, respondents emphasised that the issue of salary competitiveness is compounded by the structure and culture of the public sector. One participant noted that 'salaries do not compare, especially in government research, to external bodies... bureaucracy and lack of value in government kills many people's dreams.' Others explained that ongoing pay gaps leave the sector vulnerable to losing experienced staff to better paying industries, with one respondent stating that 'ongoing pay gaps with other industries (e.g. mining, resources, consultancy) mean experienced staff are often poached.' And another with similar thoughts said 'WA can't compete on salaries with the mining sector, so we lose skilled technical and science staff to higher-paying industries'

The link between salary and employment continuity also emerged more strongly in relation to retention. Several respondents highlighted the combined impact of low pay and insecure funding, with one observing that 'salary and job security are the two most vital criteria... researchers tend to live on a project by project basis, making continuity difficult.'

Job security

Ranked second for both attracting and retaining

Lack of job security was another major concern for respondents. Many pointed to the prevalence of short-term contracts and unstable funding arrangements as major deterrents for both new entrants and established staff. One respondent stated, 'Short-term contracts and funding cycles discourage people from entering the sector.' Another added, 'Graduates and early career staff don't see security in agricultural R&D, [there is a]1/5 chance of grant funding [also a] declining infrastructure.'

The uncertainty surrounding ongoing employment was a recurring theme. As one person summarised, 'Job security equals short term contracts rather than longer term and visibility of 'next' contract.' Others linked the problem to systemic issues, such as 'broken funding models resulting in too much competition and not enough opportunities.' Overall, the comments reflect a sector that struggles to offer long term career stability, which in turn limits its ability to build and sustain capacity over time.

There was a high degree of consistency between the feedback on job security as a barrier to attracting and retaining skilled people in WA's agricultural RD&E sector.

Some additional nuances emerged in the retention focused responses including placing greater emphasis on the impact of short-termism on career development and workforce morale, with one respondent noting, 'Contract work vs tenure, how to make roles more secure than 12 months.' And another said 'Too many roles depend on project funding, job insecurity drives people away before they can build long-term expertise'.

While attraction focused feedback emphasised how job insecurity discourages new entrants from joining the sector, the retention responses highlighted how these same conditions erode commitment, continuity, and career satisfaction among existing staff, making job security one of the most critical and persistent barriers across the workforce pipeline.

Lack of awareness of careers in agricultural RD&E

Ranked third for attracting

A limited awareness of career opportunities in agricultural RD&E was seen by respondents as a constraint on workforce attraction in Western Australia. Several participants commented on the restricted size of the local workforce and the challenge of drawing in new entrants from elsewhere, with one noting, 'lack of talent pool in WA and difficulty in attracting talent from interstate.'

Many highlighted the need for stronger visibility and promotion of the diversity of roles available across research, government, and industry. One respondent observed that 'the awareness for the career diversity is still quite limited. Further emphasis needs to be placed on research (private and university sector) and government roles (including policy and strategy).' However, they also pointed out that 'entry level roles aimed at students are often casual or seasonal, which doesn't help the poor perception of job security and career progression.'

There was a consistent view that the industry must better engage with people outside the traditional agricultural pathway, particularly young people. As one respondent explained, 'I think the industry needs to look towards ways of attracting skilled and talented people from outside of agriculture into the industry (starting from school age).'

Several participants specifically identified the lack of clear and appealing career pathways within key institutions. One respondent remarked that 'careers in DPIRD are not attractive, and in universities they are unavailable [WA] needs an elite research institute type model with sponsored studentships starting at Hons level.' Others commented more broadly on the absence of structured progression, stating 'no clear and stable career pathways for scientists.'

Finally, concerns were raised about the imbalance between training output and job availability. As one participant noted, 'There are more PhDs being produced in WA than there are jobs for them.' Together, these insights suggest that the sector needs to focus on increasing visibility of career options, building structured entry and progression pathways, and expanding employment opportunities to match the level of education and talent being developed.

Lack of awareness of a career in agriculture was not included as an issue for retaining skilled people.

Location

Ranked joint fourth for both attracting and retaining

Geographic and lifestyle factors were seen as major influences on workforce attraction. Respondents described 'a stigma of being based in the regions ... lack of housing and social supports,' and pointed to 'housing availability in regional towns, perception the SW is 'remote.'

Living and working conditions in northern and regional WA were also mentioned as barriers, with one comment highlighting ‘distance from major population centres and limited lifestyle options can be a deterrent, particularly for early-career staff.’ Also the issue of ‘Aging and isolated facilities make it hard to attract early-career professionals, regional placements need better housing, equipment, and connectivity.’ This reflects the broader challenge of regional attractiveness, where quality of life considerations intersect with structural and economic issues.

While similar to the attracting skilled people, the emphasis for retention shifted toward the lived reality of working in regional and remote WA. Respondents described the cumulative effects of limited services, partner employment opportunities, and schooling options on staff turnover, with one noting that ‘challenges of living and working regionally (distance, services, lifestyle for families) can lead to turnover, especially mid-career.’ These comments indicate that even when people are willing to take up regional roles, sustaining them long term can be difficult without adequate community and family support.

An additional nuance in the retention feedback was the mention of cultural factors within the industry itself, such as ‘Culture of farmers – lack of appreciation,’ suggesting that social and professional isolation can compound geographic isolation.

Career progression

Ranked joint fourth for attracting and third for retaining

Limited opportunities for professional advancement were repeatedly mentioned as a source of frustration for staff. Respondents pointed out ‘limited pathways and leadership opportunities in WA compared to eastern states or industry,’ and a lack of transparency in career structures. One noted, ‘Clarity on role and opportunity – have you read a DPIRD development officer job ad?’

Others stressed the importance of supportive organisational environments, explaining that ‘the right organisational structures with sustainable business models and networks that support ... early career scientists in metro, rural and remote areas’ are needed to encourage retention. A number of respondents saw career progression as interconnected with other factors such as pay, job security and infrastructure.

Similar issues were identified between attracting and retaining skilled people, but feedback pertaining to the retention of skilled people was described with greater frustration and concern about long term consequences. The tone reflected a sense of stagnation within the existing workforce, with respondents noting that ‘limited leadership roles and pathways for advancement often push people to move interstate or leave the sector.’ Several also pointed to weak managerial capacity and inadequate mentoring, reflected in comments such as ‘leader’s management ability.’

A new theme that emerged more strongly in the retention data was dissatisfaction with how progression is rewarded and recognised. One respondent said ‘Lack of clear progression pathways and recognition for mid-career staff, people feel stuck between short-term projects with no visible career development.’ Respondents felt that advancement often depends on moving outside of your expertise (technical or scientific excellence). As one respondent stated,

‘Career progression is almost gone, if you want to progress you become an administrative manager rather than being recognised for scientific capacity.’

Infrastructure

Ranked sixth for attracting and fifth for retaining

Respondents raised significant concerns about the state and accessibility of WA’s research infrastructure. One respondent observed that ‘WA lags behind other states in terms of accessibility of Ag RD&E infrastructure and where it exists, institutional barriers prevent effective sharing.’ The ageing state of existing facilities was also noted, with feedback such as ‘R&D infrastructure in WA is ageing (especially DPIRD) and there are not readily available sources of funding to improve it.’

These challenges were seen to contribute directly to workforce retention problems, with several respondents noting that ‘declining infrastructure – it’s not an appealing option compared to competing industries.’

The retention focused feedback echoed the same concerns as attracting skilled people but expanded on their long-term impact on staff experience and morale. Respondents described how a ‘lack of cutting edge research facilities and resources can frustrate staff and limit opportunities to do high quality science,’ highlighting that inadequate infrastructure not only hampers research quality but also diminishes job satisfaction and career progression. Some participants went beyond physical resources to describe deeper organisational issues, characterising the system as ‘a broken research environment that lacks leadership and provides little inspiration.’

Another new aspect in the retention feedback was the explicit recognition of how infrastructure problems interact with other systemic barriers. Several respondents tied infrastructure directly to salary competitiveness and regional location, noting that ‘Location, regional infrastructure and salary competitiveness are the three big ones.’ This reinforces the view that infrastructure challenges are not isolated but part of a broader structural weakness affecting both attraction and retention.

Diversity and inclusion

Ranked seventh for attracting and sixth for retaining

A smaller but still notable set of responses emphasised the need for greater diversity and inclusion in the sector. Respondents identified an ‘ongoing need to ensure workplaces are welcoming and inclusive, particularly for women, Indigenous people, and culturally diverse staff.’ Others reflected on cultural imbalances, describing the sector as ‘still very male dominated’ and adding that ‘LGBTQ and multicultural inclusion are lacking in a very conservative workforce.’

These comments suggest that creating a more inclusive culture would not only improve equity but also help attract and retain a broader pool of talent in agricultural RD&E.

Diversity and inclusion were central themes in both attraction and retention feedback, with respondents emphasising that the culture of the agricultural RD&E sector strongly influences

who joins and who stays. The message was clear, workplaces that are not consistently inclusive, supportive, and representative of broader society will struggle to attract and retain a diverse, skilled workforce.

Retention feedback echoed attraction concerns but went further, highlighting the need for belonging, psychological safety, and purpose driven workplaces. Respondents noted that retaining skilled people requires more than pay and job security, it depends on inclusive, flexible cultures that value and support staff across ages, genders, career stages, and backgrounds. As one participant put it, “Retention is about more than pay. Skilled people leave when they feel isolated, unsupported, or disconnected from a clear purpose.”

Ultimately, the findings show that diversity and inclusion are not just moral imperatives but essential drivers of workforce stability and engagement.

General / Other

Several respondents raised broader systemic issues that affect workforce satisfaction across multiple domains. A recurring frustration was excessive administrative burden, with one person remarking, ‘The advance of red tape is increasing mercilessly... make it easier to move between jobs / employers.’ Others simply pointed to ‘flexibility’ as a crucial yet under addressed need, while some expressed uncertainty or fatigue about the system’s complexity.

These general comments suggest that administrative constraints, rigid structures, and lack of flexibility are contributing to broader workforce dissatisfaction, reinforcing the interconnected nature of the barriers to retention within WA’s agricultural RD&E system.

7.2 Enablers to attracting and retaining skilled people

Survey question: In your opinion what enablers or support would make the biggest difference to attract people into a career in agricultural RD&E and retain skilled people? (Open text for each of Attract and Retain.)

Overview of themes

Feedback from respondents fell under 18 different themes, as presented in Table 11 below. Eight themes related to both attracting and retaining skilled staff, four were relevant to attracting skilled staff only and six were relevant to retaining staff only.

Across both attraction and retention, respondents described a coherent picture of what makes agricultural RD&E careers viable: secure funding, fair pay, clear career structures, and supportive, well led organisations. Attraction focused comments emphasised visibility, pathways, and public image, while retention focused feedback concentrated on workplace experience, stability, autonomy, and recognition. The same foundations that draw people into RD&E, security, opportunity, and purpose must also be sustained through strong organisational culture, leadership, and long-term investment to keep them there.

Table 11. Enablers to attracting and retaining skilled people

Theme	Both attraction & retention	Unique to attraction	Unique to retention
Job security and long-term funding	✓	–	–
Competitive salaries and conditions	✓	–	–
Career pathways and mentoring	✓	–	–
Organisational culture and leadership	✓	–	–
Infrastructure and collaboration	✓	–	–
Recognition and valuing RD&E	✓	–	–
Regional attraction and support	✓	–	–
Diversity and inclusion	✓	–	–
Education and sector promotion	–	✓	–
Modern industry branding	–	✓	–
Entry pathways and scholarships	–	✓	–
Career stories and visibility	–	✓	–
Reducing red tape and admin load	–	–	✓
Meaningful work and autonomy	–	–	✓
Leadership development and succession	–	–	✓
Team culture and peer networks	–	–	✓
Flexible arrangements & life balance	–	–	✓
Institutional commitment & vision	–	–	✓

Enablers common to both attraction and retention

Job security and long-term funding

This was the most dominant enabler across both groups. Respondents repeatedly emphasised the need for stable, long-term positions and multi-year funding to replace short term, project-based contracts. Job insecurity is a critical deterrent to entering or remaining in RD&E,

describing the continual competition for short term grants as ‘wearing and disheartening.’ They called for permanent roles, bridge funding between projects, and funding certainty that allows staff to plan careers and build expertise over time, ‘Stable, multi-year funding opportunities to retain staff and plan meaningful research programs.’. Job stability was directly linked to confidence, wellbeing, and the ability to retain skilled researchers and technicians.

Competitive salaries and employment conditions

Respondents across both datasets agreed that pay and conditions must match those in other industries, particularly mining and other STEM sectors. ‘Competitive salaries and condition’, ‘decent pay’, and ‘reasonable prospects of decent housing’ were viewed as non-negotiable for both attracting new entrants and retaining experienced staff. Participants also noted that financial incentives such as regional housing support, relocation allowances, and family-friendly benefits help draw and keep talent, especially in regional WA.

Clear career pathways, progression, and mentoring

Both attraction and retention comments highlighted the importance of ‘Clear career paths and mentoring support.’. Respondents called for visible progression routes, graduate and cadet programs, and leadership development opportunities to help early and mid-career professionals see a future in the sector. Mentoring and professional development were seen as critical not only for building confidence but also for supporting succession and preventing burnout. The lack of clarity in advancement was described as a major factor in staff leaving RD&E for better defined career paths elsewhere.

Organisational culture, leadership, and supportive workplaces

Responses for both attraction and retention stressed that strong, supportive leadership and organisational culture are central to retention and attraction. They called for ‘strong and positive organisational structures,’ ‘regular check-ins and recognition,’ and leaders who create space for staff to innovate and ‘try new approaches,’ and have a ‘solutions narrative [for issues such as] climate mitigation and adaptation risks and opportunities.’ Both attraction and retention responses identified that valuing ‘boots-on-the-ground’ staff, reducing administrative load, and improving management quality are essential for morale and stability. Respondents also voiced the need for ‘better collaboration between institutions – one system, not silos.’

Infrastructure and collaboration

Both attraction and retention feedback emphasised the role of modern infrastructure and collaborative environments. Respondents linked attraction to ‘state-of-the-art labs, trial sites, and digital tools,’ and retention to maintaining and investing in facilities such as ‘regional research centres’ and the proposed ‘DPIRD HQ.’ They agreed that investment in quality infrastructure signals commitment, enables excellence, and supports pride in the workplace.

Recognition and value of agricultural RD&E careers

A shared theme was the need to restore the societal and institutional value of agricultural research. Responses for both attraction and retention said that agricultural RD&E should be recognised for its contribution to food security, sustainability, and the economy. They wanted

stronger industry and government messaging that positions RD&E as a prestigious and meaningful profession, helping to attract young scientists and retain experienced practitioners.

Regional attraction and support

Both attraction and retention responses emphasised that regional housing, partner employment support, and regional professional networks are vital. Relocation grants, housing subsidies, and incentives for long term regional service were cited as ways to make regional postings more appealing and sustainable. One respondent suggested exploring FIFO or DIDO models for regional positions, improving work life balance.

Diversity, inclusion, and flexible working conditions

Respondents across both datasets identified the need for inclusive, flexible workplaces that welcome diverse entrants and support people through different life stages. They mentioned culturally safe practices for Aboriginal and Torres Strait Islander staff, flexible career entry points for career changers, and gender equity measures to support women in agriculture and STEM. Flexibility in work location and schedule (e.g., hybrid options, compressed weeks) was recognised as essential for long-term retention and attraction alike.

Themes unique to attracting skilled people

While many factors overlap, several enablers were distinctive to the attraction of skilled people into RD&E careers.

Early exposure, education, and promotion of agricultural science

Respondents strongly emphasised the need to raise awareness and improve perceptions of agricultural RD&E careers. They called for ‘promotion of career diversity and pathways in schools’, ‘exposure during study’, and ‘raising awareness of career success stories in high schools and universities.’ Campaigns showcasing the sector’s role in innovation, sustainability, and global challenges such as climate change and food security were seen as critical to inspiring new entrants.

Industry branding and public image

A major attraction specific theme was the call for a stronger, modern identity for agricultural RD&E. Respondents noted the need for a ‘fresh image that highlights innovation, sustainability, and real-world impact,’ positioning RD&E as a high-tech, future-focused field. This includes coordinated campaigns, role model promotion, and social media engagement to make the sector visible to young professionals and STEM graduates.

Entry pathways and scholarships

Attraction focused feedback often mentioned cadet programs, internships, scholarships, and graduate entry pathways as critical enablers. Respondents said these initiatives not only attract new talent but also demonstrate tangible commitment to developing the next generation of researchers and extension officers.

Showcasing career examples and success stories

Respondents suggested that demonstrating successful career journeys within RD&E, through case studies, mentoring, and alumni promotion, would encourage young people to see the sector as a viable, rewarding option.

Themes unique to retaining skilled people

The retention responses focused more heavily on the lived experience of professionals already working within RD&E and what keeps them engaged.

Reducing red tape and administrative burden

A strong retention specific theme was frustration with ‘administrative overload’ and ‘time spent applying for grants with low probability of success.’ Respondents called for streamlined systems, more autonomy, and reduced bureaucracy to let researchers focus on science, innovation, and collaboration rather than paperwork.

Meaningful work and professional autonomy

Retention comments highlighted that staff stay when their work is impactful, creative, and intellectually engaging. Respondents wanted ‘less barriers to having innovative/out-of-the-box ideas supported’ and opportunities to contribute to meaningful change. Autonomy and challenge within roles were described as key motivators for long-term engagement.

Mentoring, leadership development, and succession planning

While career pathways were common to both datasets, retention comments focused on mid-career support, succession planning, and leadership opportunities. Respondents noted that without development options, staff stagnate or leave. Programs for professional growth, coaching, and structured leadership training were seen as critical to maintaining motivation.

Workplace culture and team environment

Several retention responses emphasised the value of ‘good teams in good locations’ and ‘regular contact across grower groups and organisations’ to create belonging and purpose. A culture of trust, collegiality, and recognition was repeatedly identified as a reason people stay. Strong regional support networks and peer communities were also cited as retention factors, particularly in remote or isolated roles.

Flexibility, life balance, and recognition of individual needs

Retention feedback placed particular emphasis on accommodating staff through flexible arrangements that reflect different life stages or personal circumstances (e.g., caring responsibilities, ageing workforce, health). Comments highlighted the need for ‘highly flexible work conditions’, ‘support for personal circumstance’, and ‘recognition of achievements and ongoing service’.

Institutional commitment and long-term vision

Several respondents called for a clearer government and institutional commitment to agricultural RD&E, including ‘government injection of resources and commitment into RD&E programs’ and

‘primary industries in Western Australia do not have a chamber prosecuting their interests facing towards the state government, mining (CME and AMEC), gas (Energy Australia), SME businesses (CCIWA) all have chambers’. Support from society was also highlighted ‘Valuing agricultural research, by government and society, would make a huge difference.’ Such systemic stability was seen as critical to retaining people who might otherwise leave due to uncertainty or lack of direction.

7.3 Positive past or current initiatives to attract and retain skilled people

Survey question: What past or current initiatives have had a positive impact on recruitment and staff retention? (Open text)

Overview

Overall, respondents agreed that the most effective initiatives for recruitment and retention have been: graduate, cadetship, and scholarship programs; mentoring and leadership development; and collaborative, capacity building projects involving universities, industry, and grower groups.

Equally important were workplace flexibility, inclusive leadership, and consistent government investment. Where programs combined clear career pathways, professional development, and recognition of scientific value, they delivered measurable improvements in both recruitment and retention. However, respondents stressed that these gains will only be sustained if future programs are backed by long term funding, continuity of support, and institutional commitment across the RD&E system.

Graduate, cadetship, and scholarship programs

Graduate entry programs, cadetships, and scholarships were repeatedly highlighted as ‘really valuable in giving new entrants a start and keeping them in the sector’. Examples included internal graduate programs, early career fellowships, and cadetships through DPIRD and universities such as Murdoch, UWA, and Curtin. These initiatives provided structured pathways, mentoring, and exposure to real world research.

Respondents also pointed to Honours and PhD scholarships, studentship top-ups, and industry linked programs through CRCs, GRDC partnerships, and WAARC supported PhD projects as important for building capacity. Programs that combined academic study with hands on experience, such as work placements or grower group projects, were considered particularly effective. However, several noted that while these programs were strong entry points, they rarely translated into permanent employment due to the lack of available ongoing roles.

Mentoring, leadership, and career development initiatives

Mentoring and leadership programs were viewed as valuable for both recruitment and retention, especially when senior staff had time and recognition to support early career colleagues. Respondents praised initiatives that rewarded experienced scientists for mentoring, built peer support networks, and offered leadership training for mid-career staff, saying 'Internal graduate programs, short courses, capability development and mentoring opportunities have had the biggest impact on retention.'

Programs such as Nuffield, ARLP, and Horizon scholarships were recognised for raising awareness of leadership within agriculture and inspiring participants to stay in the sector longer. Respondents also highlighted the importance of clear career pathways, access to ongoing professional development, and recognition programs as effective retention tools, helping staff see long-term opportunities and career progression.

Collaborative and capacity building programs

Several respondents identified cross institutional collaborations such as Cooperative Research Centres (CRC) Centre for Legumes in Mediterranean Agriculture (CLIMA), Western Australian Livestock Research Council (WALRC), and other national research hubs as highly effective in fostering networks, career opportunities, and professional growth. One respondent reflected 'Supporting WA researchers to undertake world-class training and collaborations through CRCs and national networks has had clear benefits.' These initiatives 'built on matching skills and collaboration rather than competition and limited budgets,' creating environments where researchers could focus on science rather than administration.

Programs supported by organisations like WAARC, GRDC, and grower groups were recognised for helping regional professionals access funding, mentoring, and research opportunities. Capacity building initiatives and partnerships connecting universities, industry, and grower groups were viewed as vital for maintaining momentum in the workforce pipeline.

Regional and industry embedded opportunities

Respondents repeatedly mentioned grower group led projects, regional scholarships, and internships as successful in attracting people to regional RD&E roles. One respondent commented 'Regional scholarship programs, internships, and placements have helped connect students with employers and keep them in the regions.' These initiatives provided meaningful work close to producers, fostering connection and purpose that improved retention. 'Graduate programs or early-career fellowships that include regional placements or industry partnerships have been really valuable in giving new entrants a start.' One participant noted that regional NRM and industry bodies offered more fulfilling roles than government or university positions because they provided visible impact and stronger community ties. Investment in local research hubs, regional infrastructure, and collaboration with grower groups was seen as an ongoing priority to support regional recruitment and long-term retention.

Supportive workplace conditions and organisational culture

Several comments identified flexible and supportive workplace conditions as key to retaining skilled staff. Respondents mentioned work life balance systems such as time off in lieu (TOIL), part time arrangements, parental leave, and flexible hours as highly valued initiatives. A few noted that while remuneration could rarely match other sectors, 'we can deliver on work/life balance,' particularly when driven by strong leadership from boards and CEOs. Respondents described that workplaces fostering genuine respect, empowering leadership, and open communication achieved better retention. Examples included team recognition programs, wellbeing initiatives, and culturally inclusive social events. A few noted that when organisations promoted 'a recognised value in science and scientists,' morale improved, and so did retention.

Government and institutional investment

Participants reflected on how government investment decisions have historically shaped RD&E recruitment and retention. Some mentioned that funding boosts (e.g. CSIRO during COVID) temporarily supported recruitment. Respondents agreed that ongoing government commitment, consistent policy direction, and adequate core funding were essential for long term retention. A few called for re-establishing strong institutional models, similar to the DPIRD cadetships of the 1970s, which were regarded as an outstanding investment in long term capacity.

Examples of programs with positive impact

Respondents provided numerous examples of specific initiatives viewed as beneficial:

- **ICMJ (Australian Intercollegiate Meat Judging Association)** - cited as 'hugely successful in recruiting and retaining early career researchers and industry people.'
- **Taste 2020 marketing campaign** - credited with showcasing WA produce and generating new value-add employment opportunities.
- **Graduate and early career entry programs at DPIRD** - described as successful but short lived after funding cuts.
- **WA ATAR x 2 agribusiness and agricultural science courses** - although it was reported the sector does not fund the promotion of these to secondary schools or provide resources to teachers.
- **PhD and post-doctoral opportunities** linked to CRCs and university partnerships, viewed as effective in developing research talent.
- **Regional scholarship programs and internships** supported by GRDC, universities, and grower groups described as 'successfully attracting early-career staff into RD&E.'

7.4 Effectiveness of current career pathways

Survey question: How effective do you believe current career pathways are in attracting, developing, and retaining talent in the agricultural RD&E sector? (Respondents asked to select a level of effectiveness on a scale and explain their response.)

Overview

Overall, respondents were evenly divided between rating current career pathways as not effective (n=37, 49%) or moderately effective (n=38, 51%), with none viewing them as fully effective (see Table 12).

Across all responses, there was a strong consensus that career pathways in agricultural RD&E are underdeveloped, fragmented, and unsustainably funded. Entry points such as graduate and scholarship programs exist, but continuity, professional development, and long-term security are missing.

Respondents want to see:

- Permanent positions and clear promotion structures
- Nationally consistent career frameworks across research, technical, and extension roles
- Ongoing mentoring and leadership development at all career stages
- Reduced administrative burden and more flexible mobility between institutions

The current RD&E career environment is perceived as moderately effective at best, with major systemic barriers to building and retaining a skilled, motivated workforce.

Table 12. Effectiveness of current career pathways

Response options	%	Number
Not effective	45	37
Moderately effective	45	38
Very effective	0	0
Unsure	12	10

Not effective

Most respondents viewed career pathways in agricultural RD&E as unclear, short-term, and reliant on insecure project funding. Early career staff struggle to find ongoing roles, with many on short contracts tied to grants. The absence of long-term positions and defined progression steps drives high turnover and loss of skilled people to more stable sectors such as mining, agribusiness, and government.

Limited mentoring, role clarity, and promotion opportunities were also common concerns. Respondents said pathways ‘don’t exist beyond entry level,’ and that staff often ‘reapply for their own jobs every few years.’ Bureaucracy was seen as draining enthusiasm and discouraging innovation. Many called for a coordinated career strategy across universities, DPIRD, and grower groups to reduce duplication and isolation. Overall, the sector’s career pathways are seen as fragmented and weakly linked to long-term capacity building.

Moderately effective

Respondents in this group acknowledged some positive initiatives, particularly graduate programs, mentoring, and partnerships between universities, RDCs, and grower groups, but said these efforts are patchy, short-lived, or inconsistently applied. A few noted that structured entry programs ‘help bring people in,’ but ‘there is little follow-through to keep them.’

Common strengths mentioned included:

- Early career development through scholarships, internships, and mentoring
- A small but growing recognition of the need for leadership and management training
- Some improvement in cross-sector collaboration (e.g. between DPIRD, CSIRO, universities, and grower groups)

However, respondents said these are undermined by systemic weaknesses such as poor succession planning, limited mobility between institutions, and the absence of a shared national framework for career progression. Comments described current systems as ‘dependent on individual supervisors rather than organisational structure,’ with success often relying on personal networks instead of transparent criteria. One participant summed up this mixed view, ‘There are some good pathways for graduates, but it’s hit and miss beyond that. It depends on who you work for and what funding cycle you’re caught in.’

Unsure

Respondents who were unsure generally cited limited visibility or understanding of available career pathways. Several worked outside formal research roles (e.g. in policy, extension, or private consulting) and said they were ‘not aware of structured RD&E pathways’ within the sector. Others noted they had seen multiple reviews and pilot programs come and go, making it hard to judge what was currently in place. Typical comments included, ‘I’m not sure what formal pathways exist,’ and ‘There have been reviews and reports, but little evidence of implementation.’ This uncertainty may reflect a broader lack of transparency and communication about what agricultural RD&E career opportunities exist in WA and nationally.

7.5 Most significant succession risks

Survey question: Where are the most significant succession risks in WA agricultural RD&E and why? (i.e., roles where only a few people hold unique expertise) (Open text.)

Overview

Table 13 presents the discipline areas that respondents flagged as most significantly at risk. Succession risks in WA's agricultural RD&E are widespread and acute, particularly in specialist technical, research, and extension roles where only a few individuals hold deep, experience-based expertise. Respondents consistently described an ageing workforce, limited mid-career replacements, and weak succession planning systems, resulting in the erosion of institutional knowledge and the potential loss of critical research capacity.

Table 13. Discipline/ specialist areas most significantly at risk

Discipline / specialist area	%	Mentions (n)
Extension / Adoption / Facilitation	14	10
Pathology / Plant Pathology	12	9
Soil Science / Soil Biology / Soil Systems	11	8
Farming Systems	8	6
Agronomy / Agronomists	7	5
Biosecurity / Diagnostics	7	5
Rangeland Ecology / Grazing Systems / Rangeland Science	5	4
Genetics / Bioinformatics / Animal Breeding / Disease Resistance	4	3
Horticulture (including development and extension)	4	3
Water Science / Hydrology / Farm Water Supply	4	3
Agricultural Systems Modelling / Decision Support / Data Science / Agtech / Digital Tools	4	3
Plant Nutrition / Crop Nutrition	3	2
Animal / Livestock / Ruminant Nutrition	3	2
Crop Physiology / Plant Physiology	3	2

Entomology	3	2
Climate Science / Climate Adaptation	3	2
Agricultural Engineering	1	1
Botany / Taxonomy	1	1
Evaluation	1	1
Quality / Product Quality	1	1

High-risk disciplines and roles

Extension and adoption science

Repeatedly described as a major risk area: ‘Very few people can bridge producers, researchers, and industry,’ and ‘trusted, regionally embedded practitioners are mid to late career.’ Without succession here, ‘science will never reach the ground.’ Extension having the most mentions may be due to all research disciplines requiring some form of extension to achieve on ground impact.

Soil science and hydrology

Multiple respondents highlighted ‘a small, ageing cohort’ with ‘deep knowledge of WA’s sandy and duplex soils, hydrology, and water capture.’ Replacements are limited, training pipelines are long, and few domestic students are choosing these fields.

Plant pathology, biosecurity and diagnostics

‘Only a handful of experts’ remain in crop disease surveillance, plant virology, nematology and biosecurity diagnostics. These roles were described as ‘seriously understaffed’ and dependent on institutional memory, with a ‘national shortage of plant pathologists.’

Agronomy and farming systems

‘Many capable research, extension, and field staff are ageing,’ with ‘no meaningful mechanisms for succession planning.’ Localised agronomic knowledge is at risk, particularly for low-rainfall and marginal zones.

Rangeland ecology and grazing systems

‘Highly specialised roles held by a small number of senior experts’ in rangeland ecology, landscape function assessment, and integrated grazing management, where ‘experience based regional knowledge cannot easily be replaced.’

Data modelling and decision-support systems

‘A small cohort of experienced systems modellers’ hold skills in Agricultural Production Systems sIMulator (APSIM) and digital forecasting, but there is ‘slow uptake by early career professionals’ due to the high technical barrier and lack of mentoring.

Animal and pasture science

Specific mention of ‘genetics and management of disease resistance,’ ‘applied ruminant nutrition,’ and ‘soil–pasture–nutrient interactions,’ with few replacements in the pipeline.

Horticulture

Development and extension in horticulture face risks because it is a ‘minority crop’ area with ‘lower links to tertiary institutions.’

Systemic causes

Ageing workforce

‘We are looming towards a cliff edge regarding senior researchers at retirement age with few or limited number of talented individuals at the ready to step into their roles.’

No formal succession planning

Government agencies ‘pressure older staff out and then realise they’ve lost capacity,’ while ‘a one-in-one-out approach prevents junior people from learning from senior people before they retire.’

Loss of mentoring and career pathways

‘No mentor programs, short-term contracts, and limited career progression’ make it difficult for early and mid-career researchers to stay in public RD&E.

Funding instability

‘Declining government investment,’ ‘short-term projects,’ and ‘loss of research farms [has] haemorrhaged institutional knowledge.’

Competition and salary differentials

The mining and private sectors attract younger talent away from agriculture.

Weak domestic training pipeline

‘Most postgraduates are international students, [who] lack regional knowledge and grower networks,’ increasing vulnerability in applied fields.

General

Respondents warned of a massive risk of lost tacit knowledge, fragmented expertise, and ‘research needing to be restarted.’ Many stressed that rebuilding capacity ‘costs more in the long term’ and that the absence of overlap between retiring and incoming staff ‘threatens continuity in applied research and extension delivery.’

Succession-risk matrix

Table 14 below summarises the most significant succession risks identified across Western Australia’s agricultural RD&E workforce. It combines survey evidence on workforce age profile, pipeline strength and criticality to RD&E outcomes with a qualitative assessment of key vulnerabilities and recommended mitigation actions. The analysis highlights where the loss of

expertise would have the most serious implications for RD&E delivery, adoption and innovation, and where targeted investment in mentoring, training and recruitment will deliver the highest return. For more information on the succession-risk matrix method, see Appendix 5.

Interpretation

Succession risks are widespread but vary in severity. Extension, Plant pathology and Soil science present the highest immediate risks, with ageing specialists, limited mentoring and very few early-career replacements. Agronomy and Rangeland ecology show regionally concentrated risks linked to declining on-farm trial capacity and limited incentives for remote roles. Digital Agriculture represents an emerging risk, a younger but thin cohort with minimal senior guidance and strong competition from the private sector. Disciplines such as Animal & pasture science, Horticulture, and Genetics/Breeding remain moderately stable but require ongoing skills renewal to maintain capacity.

Overall, the analysis shows that without deliberate succession planning, Western Australia faces a ‘knowledge cliff’ in several high impact disciplines within the next decade. Targeted mentoring, structured career pathways and cross institutional collaboration are the most effective levers to mitigate these risks and sustain RD&E excellence across the state.

Table 4. Succession risk matrix

Discipline / specialist area	Age profile / pipeline strength	Criticality to RD&E outcomes	Succession risk level	Key vulnerabilities	Suggested mitigation actions
Extension / Adoption / Facilitation	Ageing workforce, few mid-career replacements	High - critical to research adoption and impact	Extreme	Mid-to-late-career dominance; loss of mentoring capacity; weak career structures	Rebuild extension pipeline; formal mentoring and credential programs; multi-year regional extension roles
Plant pathology / Diagnostics / Biosecurity	Very small national pool; few new entrants	High - essential for plant health and market access	High	National shortage; long training lag; institutional memory loss	Co-fund diagnostic traineeships; national shared appointments; early-career fellowships
Soil science / Hydrology / Soil biology	Ageing cohort; weak student inflow	High - underpins sustainability & productivity	High	Limited postgraduate interest; loss of field expertise	Regional soil hubs; postgraduate scholarships; mentoring by senior scientists
Agronomy / Farming systems	Moderate age skew; moderate student inflow	High - core to applied systems research	High - Moderate	Declining regional presence; shortage of trial technicians	Graduate placements; regional agronomy hubs; technician training

Rangeland ecology / Grazing systems	Small specialist cohort, remote-based	Moderate	High (localised)	Isolation; limited succession; few incentives for remote postings	Incentivised regional research fellowships; virtual mentoring networks
Data modelling / Digital agriculture	Young but thin cohort; few senior mentors	Very high – cross cutting capacity	Emerging Risk	Insufficient mentoring; limited senior expertise; high private sector pull	Cross-institutional digital mentors; data-science graduate pathways; retention incentives
Animal & pasture Science / Nutrition	Mixed-age profile; mid-career gap	Moderate	Moderate	Reduced research-farm access; limited training sites	Restore field infrastructure; support applied livestock research placements
Horticulture development & extension	Small workforce; few RD&E linkages	Moderate	Moderate	Weak research–industry connection; limited recognition	Cross-sector training; co-funded industry RD&E roles
Genetics / breeding / Bioinformatics	Mid-senior heavy; moderate pipeline	Moderate	Low - Moderate	Few early career bioinformaticians; skills modernisation needed	Specialist bioinformatics training; succession mentoring; national linkages

7.6 Adequacy of diversity and inclusion

Survey question: Do you think diversity and inclusion (e.g. gender, Indigenous participation, Culturally and Linguistically Diverse (CaLD), international recruits) are being adequately addressed in WA's agricultural RD&E workforce? (Respondents provided options for level of adequacy, plus open text for reason/s)

Overview

Responses were mixed as to whether diversity and inclusion were adequately addressed in WA agricultural RD&E. Thirty percent (n=25) believe it is adequately addressed, thirty seven percent (n=31) indicated it is partially addressed, fifteen percent (n=13) advised it is not addressed adequately and eighteen percent (n=15) are unsure (see Table 15 below).

Those answering 'Yes' pointed to visible gains in gender balance and international recruitment, particularly among early and mid-career researchers. However, many noted persistent gaps in senior leadership and Indigenous representation. The largest group, who answered 'Partially,' saw diversity efforts improving but inconsistently applied, stronger in government and universities than in the private sector and often limited to entry level participation rather than

genuine inclusion. Respondents who answered 'No' described current initiatives as tokenistic or rhetorical, citing entrenched conservatism and lack of structural change. Overall, diversity and inclusion are improving but not yet embedded, with meaningful change requiring stronger leadership, accountability, and cultural transformation across the RD&E system.

Table 15. Adequacies of diversity and inclusion

Response	%	Number
Yes	30	25
Partially	37	31
No	15	13
Unsure	18	15

'Yes' responses

Respondents who answered 'Yes' generally believed that diversity and inclusion in WA's agricultural RD&E sector are improving, particularly in relation to gender balance and international recruitment. Several noted visible progress in attracting a more diverse workforce, with one commenting that 'there is significant diversity in early and mid-career researchers across the industry.' Others recognised continuing progress but emphasised that representation remains uneven, particularly at senior levels and in Indigenous participation. As one respondent explained, 'Yes, but more progress is needed... representation remains uneven, especially in senior leadership roles and Indigenous participation.'

'Partially' responses

The largest group of respondents answered 'Partially', indicating that diversity and inclusion are being addressed in some areas but unevenly across the system. They recognised visible improvements in gender and cultural representation but felt that genuine inclusion and influence were still limited. As one participant observed, 'Visible diversity across the sector, but inclusion is often limited to participation at entry level.' Although another said there is a need for 'international students with English as a second language receive strong support for regional career placements with industry during their tertiary degrees, so they get their boots dirty and are quickly employed on conclusion of their degrees'. Respondents pointed to stronger progress within government and universities compared with the private sector but identified continuing challenges in achieving Indigenous representation and leadership diversity, especially in regional workplaces.

'No' responses

Those who responded 'No' viewed current diversity and inclusion efforts as largely tokenistic or inconsistent. They felt that organisational actions were more rhetorical than structural, with one respondent stating, 'We talk the talk but inclusion is still a problem at senior levels.' Another

commented that ‘diversity and inclusion are buzz words in most agencies; there needs to be significant training and restructuring of processes.’ Several described the sector as conservative and resistant to change, and two respondents characterised it as ‘a boys club’ that continues to discourage participation by women.

‘Unsure’ responses

Those who were ‘Unsure’ often lacked visibility or direct experience of diversity and inclusion activities. Several indicated they were not close enough to WA operations to assess the situation. Others commented that workforce shortages mean organisations ‘get what we get,’ suggesting that diversity considerations are secondary to filling roles. Overall, these responses reflected limited awareness of existing diversity policies or data and a perception that workforce supply pressures currently overshadow diversity objectives.

Top five priorities for diversity and inclusion

The top five diversity and inclusion priorities for WA agricultural RD&E are:

1. Strengthen Indigenous participation and cultural capacity
2. Improve gender equity and leadership representation
3. Embed inclusion into organisational culture and leadership practice
4. Broaden diversity beyond gender to include cultural, generational, and professional diversity
5. Move from representation to genuine inclusion and influence

Together, these priorities point to a system that must shift from surface level representation to deep, structural inclusion, ensuring that diverse people not only enter RD&E but thrive, lead, and shape its future direction.

Strengthen Indigenous participation and cultural capacity

Respondents consistently highlighted underdeveloped engagement frameworks, limited Indigenous representation, and weak cultural capacity across institutions. They called for:

- Dedicated pathways for Aboriginal and Torres Strait Islander researchers (scholarships, cadetships, on-Country training).
- Genuine partnerships with Indigenous land managers that embed Indigenous knowledge, not token inclusion.
- Cultural safety and awareness training for all RD&E staff. As one respondent noted, ‘representation remains uneven, especially in senior leadership roles and Indigenous participation.’

Why this is important: This links directly to the Indigenous knowledge and experience capacity area identified earlier (67–68 % want increased capacity/training). It represents both an inclusion goal and a scientific opportunity to integrate Indigenous ecological knowledge into sustainability and NRM programs.

Improve gender equity and leadership representation

Respondents widely agreed that gender diversity has improved, especially in early and mid-career cohorts, but remains poor in senior leadership, management, and governance roles. Key comments included:

- ‘Significant diversity in early and mid-career researchers, but leadership remains male-dominated.’
- Participants linked this to organisational culture, calling for proactive leadership development and promotion systems that advance women beyond mid-career bottlenecks. ‘We talk the talk but inclusion is still a problem at senior levels.’

Why this is important: Reinforces mentoring and leadership priorities already dominant across the survey, particularly the need for structured career pathways and succession planning that explicitly address gender imbalance.

Embed inclusion into organisational culture and leadership practice

Respondents stressed that diversity policies must be genuinely embedded in workplace culture, not just rhetorical. Typical feedback included:

- ‘Diversity and inclusion are buzzwords in most agencies; real change requires training and restructuring.’
- Respondents called for leaders who actively model inclusive behaviour, create psychologically safe workplaces, and build teams that value varied perspectives.

Why this is important: This aligns with earlier themes around organisational culture and leadership as key retention drivers. It reframes inclusion as a leadership competency rather than an HR add on.

Broaden diversity beyond gender: cultural, age, and career background

Respondents urged a shift from viewing diversity narrowly (mostly gender) to embracing cultural, generational, and professional diversity. Key points included:

- A need for greater multicultural inclusion and support for LGBTQ staff.
- Recognition of the ageing workforce and the importance of intergenerational teams.
- Encouragement for career changers and people from outside agriculture.
- Diversity goals must be integrated into recruitment and workforce design, not left to chance.

Why this is important: This connects to the earlier identified Interdisciplinary Capacity and Workforce Development themes building a system that values varied perspectives strengthens innovation and problem-solving capacity.

Move from representation to genuine inclusion and influence

The largest group (37 %, ‘Partially’) described the system as improving in representation but still lacking real inclusion and influence. They noted that diverse individuals are often visible but not empowered:

- 'Visible diversity across the sector, but inclusion is often limited to participation at entry level.'
- Concrete inclusion measures such as mentorship programs for diverse staff, diverse selection panels, and monitoring of inclusion outcomes.
- government and universities seen as further advanced than private and regional organisations.

Why this is important: Diversity and inclusion underpin many of the workforce issues highlighted elsewhere, leadership, mentoring, succession, and regional attraction all benefit from more inclusive and flexible organisational cultures.

This priority bridges diversity metrics with retention outcomes, inclusion must translate into decision making power, voice, and opportunity to sustain workforce engagement.

7.7 Strengthening workforce capacity

Survey question: In your view, what is the single most important investment WA should make to strengthen human capacity in agricultural RD&E over the next 5 to 15 years? (Open text)

Overview

Responses for the single most important investment WA should make to strengthen human capacity in agricultural RD&E of over the next 5 to 15 years - are grouped into the following themes, with most reported theme being first:

1. Secure and attractive career pathways
2. Infrastructure and institutional investment
3. Workforce attraction, remuneration, and recognition
4. Mentoring, leadership development, and fellowships
5. Collaboration and system integration
6. Promoting agriculture's image and relevance

Respondents stressed that without long term investment in people and facilities, WA risks losing its RD&E expertise and capacity to innovate over the next decade.

Secure and attractive career pathways

Many respondents emphasised the need for clear, long-term career pathways to attract and retain skilled staff. This included public sector and university career structures, better pay, and greater job security. Comments noted that 'clear career pathways through public sector entities DPIRD, CSIRO and the universities' are critical, while others argued that 'short contracts do not entice full-time engagement in agricultural RD&E.' The message was consistent: instability and limited progression opportunities discourage new entrants and drive mid-career talent away.

Infrastructure and institutional investment

Respondents consistently emphasised the need to upgrade research facilities, strengthen regional infrastructure, and modernise institutional settings to better support agricultural RD&E. One respondent reported ‘appalling under resourced glasshouse infrastructure across WA research organisations.’ Another highlighted the missed opportunity of ‘moving DPIRD and CSIRO to Murdoch’ as a step that could have strengthened collaboration and provided access to state-of-the-art research facilities. Others suggested investing in ‘better infrastructure’ and ‘increasing infrastructure in regional locations’ to make field research and extension roles more viable and attractive. Improving physical resources, such as laboratories, field stations, and shared facilities, was seen as critical to enabling high quality research, fostering collaboration, and encouraging skilled staff to live and work in regional areas. One respondent suggested to take ‘grains agronomic extension out of DPIRD to a new commercial model, to revitalise delivery and efficiency’.

Workforce attraction, remuneration, and recognition

Several responses linked the sector’s workforce challenges to low salaries, limited recognition, and competition from mining. As one noted, ‘The consistent message from government and media is that mining is everything in WA. Ensuring the importance of agriculture and the opportunities offered by the industry are well communicated and represented will be key to attracting future human capacity.’ Respondents argued that competitive salaries and stronger public recognition of agricultural RD&E would help attract skilled researchers and retain existing staff.

Mentoring, leadership development, and fellowships

There was strong support for mentoring and structured professional development programs to build capacity and succession. Examples included ‘funded mentoring programs’ and calls for a ‘well-funded WA Fellows Program’ to attract mid to senior level researchers, embed them in collaborative projects, and provide mentoring for local early career scientists. These initiatives were viewed as essential to maintain knowledge continuity and leadership capacity across institutions.

Collaboration and system integration

Respondents also stressed the importance of cross-institutional partnerships and a more integrated RD&E system that allows people, knowledge, and resources to flow more freely between organisations. They proposed the development of ‘a cross institutional ag research centre that allows easier staff movement and resource sharing between partner organisations’ as a practical step towards greater alignment between DPIRD, CSIRO, and the universities. Co-design and collaboration between research and extension teams were identified as essential for creating a more unified RD&E network that leverages the strengths of all contributors and reduces duplication across institutions.

Promoting agriculture's image and relevance

A smaller but recurring theme related to raising the profile of agriculture as a modern, rewarding, and essential industry. Respondents noted that the dominance of mining in WA's public narrative undermines agricultural career attraction. Investment in communication, outreach, and promotion of agricultural science was seen as vital to rebuild prestige and appeal.

Other (WAARC-related)

Several respondents commended WAARC for improving collaboration and alignment, describing it as 'a great step forward in improving outcomes for WA's ag industries.' Others argued that WAARC's rules and processes need to evolve, suggesting it should 'enable and encourage voluntary collaboration rather than requiring at least two organisations on any project,' and that bureaucracy and red tape be reduced. Another felt strongly and said, 'WA's future nutrition and food security will depend on WAARC being recognized and funded on par with the WA Biodiversity Science Institute (WABSI) and the WA Marine Science (Institute) WAMSI, and then the 3 platforms providing cross cutting solutions for the biotic part of the economy.' Respondents also noted that 'four universities in competition aren't helping,' and encouraged more cross institutional approaches through shared centres and joint appointments.

7.8 Summary of priorities for attracting and retaining skilled workforce

Across sections 6 and 7 above, consistent priority themes to strengthen human capacity and to attract and retain a skilled workforce in WA agricultural RD&E of over the next 5 to 15 years are:

1. Secure, attractive career pathways and mentoring systems
2. Modern, well-resourced infrastructure and regional hubs
3. Competitive remuneration and recognition of agricultural RD&E
4. Leadership development and fellowship programs for succession
5. Cross institutional collaboration and system integration
6. Public perception and career awareness Promoting agriculture's image and relevance

Table 16 below adds to this cross-survey perspective by highlighting alignment between respondents' number one priority to strengthen WA's RD&E workforce with priorities from earlier sections (attracting and retaining skilled people and building RD&E capacity).

Table 16. Areas of strongest cross-survey alignment

Theme / priority area	Strengthening WA human capacity	Alignment with earlier sections	Key insight
1. Career pathways, mentoring & succession	Calls for secure, long-term roles, mentoring, and structured career development to ensure continuity.	Fully aligned with both earlier sections where mentoring and workforce development were top-ranked priorities.	Consistent system-wide message: structured mentoring and career progression are the foundation of future RD&E capacity.
2. Infrastructure & institutional investment	Emphasises modern, well-resourced regional research hubs and institutional renewal.	Reinforces calls for infrastructure renewal and regional support in earlier capacity and retention findings.	Investment in facilities and regional capacity is critical to attract and retain staff and deliver quality science.
3. Competitive remuneration & recognition	Links workforce attraction directly to improved pay, job security, and the public image of agricultural research.	Salary and employment security ranked top barriers in attraction and retention sections.	Economic and social recognition of RD&E careers is essential for talent attraction and long-term stability.
4. Leadership Development & Fellowships	Proposes leadership programs and a WA Fellows initiative to mentor emerging researchers and strengthen succession.	Strongly aligns with professional development priorities and succession themes.	Leadership pipelines and recognition programs are needed to retain and develop institutional expertise.
5. Cross-Institutional Collaboration & Integration	Promotes coordinated appointments and shared workforce models across DPIRD, CSIRO, universities, and grower groups.	Echoes 'boundary spanning' and collaboration themes in earlier sections.	System-wide integration is vital to overcome fragmentation and build a connected RD&E workforce.
6. Public perception and career awareness	Smaller but recurring theme related to raising the profile of agriculture as a modern, rewarding, and essential industry	Ranked third in barriers to attraction; aligns with need for stronger visibility and promotion of diverse agricultural workforce opportunities.	Investment in communication, outreach, and promotion of agricultural science as a career is vital to rebuild prestige and attractiveness, especially to younger generations.

8. Review against broader strategies & trends

Survey results confirm strong alignment between WAARC's programs, DPIRD's strategic intent focus areas, and emerging agricultural megatrends identified in the Literature Review for this Needs Analysis. Stakeholders emphasised that people, not just research, are the key to success. Investment in workforce pipelines, mentoring, digital and extension capacity, and regional infrastructure is essential to realise WA's RD&E goals. Without it, the state risks talent loss, slower innovation, and reduced resilience; with it, WA can build a connected, future-ready agricultural system.

WAARC program areas

WAARC's six program areas have been reviewed against the survey findings, grouped under each program theme and highlighting areas of alignment, new insight, and implications for WA agriculture. The survey findings support WAARC's six program framework RD&E program focus areas, but findings also expose the human capacity engine required to deliver it. Across every program area, respondents emphasised people, translation, and place-based capacity, digital specialists, extension scientists, technicians, and culturally capable regional staff, more than new research topics. For further detail see Appendix 6.

DPIRD's strategic intent focus areas

There is strong alignment between DPIRD's strategic intent focus areas and the priorities identified by WA stakeholders. Both the literature review and survey results highlight consistent needs in data and digital capacity, extension and communication, climate, water and systems agronomy, and workforce development pipelines, with marked difference in consequence of investment versus inaction. For further details see Appendix 7.

Megatrends shaping agriculture themes

The literature and survey converge on a clear message: WA's agricultural RD&E future hinges on digital transformation, climate readiness, extension excellence, and human-centred capacity. Without sustained investment in people, infrastructure, and integration, the system will remain fragmented and reactive. Strategic investment in these nine areas will allow WA to anticipate megatrends, innovate faster, and translate science into sustainable value across its agricultural industries. For further details see Appendix 8.

9. Conclusion

The WAARC Agricultural RD&E Human Capacity Survey reveals a workforce that is skilled and committed but under increasing structural strain. Across more than 90 respondents, a consistent message emerged: Western Australia's agricultural innovation depends as much on people and capacity systems as on technical research.

Extension and communication, data and digital capacity, agronomy, climate adaptation, and systems integration were repeatedly identified as the disciplines most in need of investment. Mentoring and workforce development surfaced as the single most important enabler, highlighting the urgency of structured career pathways, leadership development, and succession planning. The analysis also shows that without intervention, capacity in critical areas, particularly extension, plant pathology, soil science, and digital agriculture will continue to decline as senior experts retire, and recruitment pipelines remain thin.

Respondents emphasised that attraction and retention challenges are rooted in insecure funding, uncompetitive salaries, weak career structures, and ageing infrastructure. Effective solutions therefore extend beyond training to institutional renewal, permanent roles, multi-year funding, modern research facilities, regional housing and employment support, and inclusive workplace cultures. Diversity and inclusion are improving but remain uneven, requiring stronger leadership commitment and culturally capable organisational practice.

Across all findings, a coherent vision emerges for WA's RD&E future, a digitally capable, extension-literate, climate-ready, and inclusive workforce supported by mentoring, modern infrastructure, and cross institutional collaboration. Strategic investment in these human capacity foundations will determine whether WA's RD&E system remains fragmented and reactive or evolves into a resilient, integrated network capable of driving innovation and sustainability over the next 15 years.

10. References

CSIRO (2020) Corporate Plan 2020–21. Canberra: Commonwealth Scientific and Industrial Research Organisation.

GRDC (2025) Right-Sizing GRDC RD&E Investment Review. Canberra: ACIL Allen Consulting for the Grains Research and Development Corporation.

OECD (2023) Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption. Paris: OECD Publishing.

UK Research and Innovation (2021) Evaluation Framework v2 Final. Swindon: UKRI.

UNESCO (2021) Science Report 2021: The Race Against Time for Smarter Development. Paris: UNESCO Publishing.

11. Appendices

Appendix 1: Capacity heat map method

Step 1: Raw data extraction

Extract these columns:

Excel Field (expected in 'Q9' tab)	Purpose
A: Capacity Area / Discipline	Defines each row (e.g., Data & Digital, Climate Adaptation, Extension & Adoption, etc.)
B: Current Capacity (1–10 scale)	Used as the base capacity rating
C: Capacity Change – Increase (I %)	% of respondents wanting capacity to increase
D: Capacity Change – Decrease (D %)	% wanting it to decrease
E: Capacity Change – Stay Same (S %)	% satisfied with current capacity
F: Training Change – Increase (I %)	% wanting training/upskilling increase
G: Training Change – Decrease (D %)	% wanting less training
H: Training Change – Stay Same (S %)	% satisfied with current training

Step 2: Data Processing

1. Convert percentage strings (e.g., 'I:96 D:0 S:4') into separate numeric columns.
2. Calculate two indices:
 - Capacity Gap Index (CGI) = $(10 - \text{Current Capacity}) \times (\% \text{ Increase Capacity} \div 100)$
 - Training Gap Index (TGI) = $(10 - \text{Current Capacity}) \times (\% \text{ Increase Training} \div 100)$
3. Normalise CGI and TGI between 0 and 1 for colour scaling.
4. Rank each area by descending CGI and TGI to show where investment is most critical.

Step 3: Heat Map Visualisation

- Rows = Capacity Areas (from 'Q9').
- Columns = Current Capacity, % Capacity ↑, % Training ↑, CGI, TGI.
- Colours: Red (Critical Gap) = Top quartile (CGI > 0.8); Amber (High) = 0.6–0.8; Yellow (Moderate) = 0.4–0.6; Green (Stable) = <0.4. (WAARC notes these groupings don't exactly match colour coding in Table 7 – but have left as is)

Appendix 2: Additional figures for current workforce capacity and future training needs

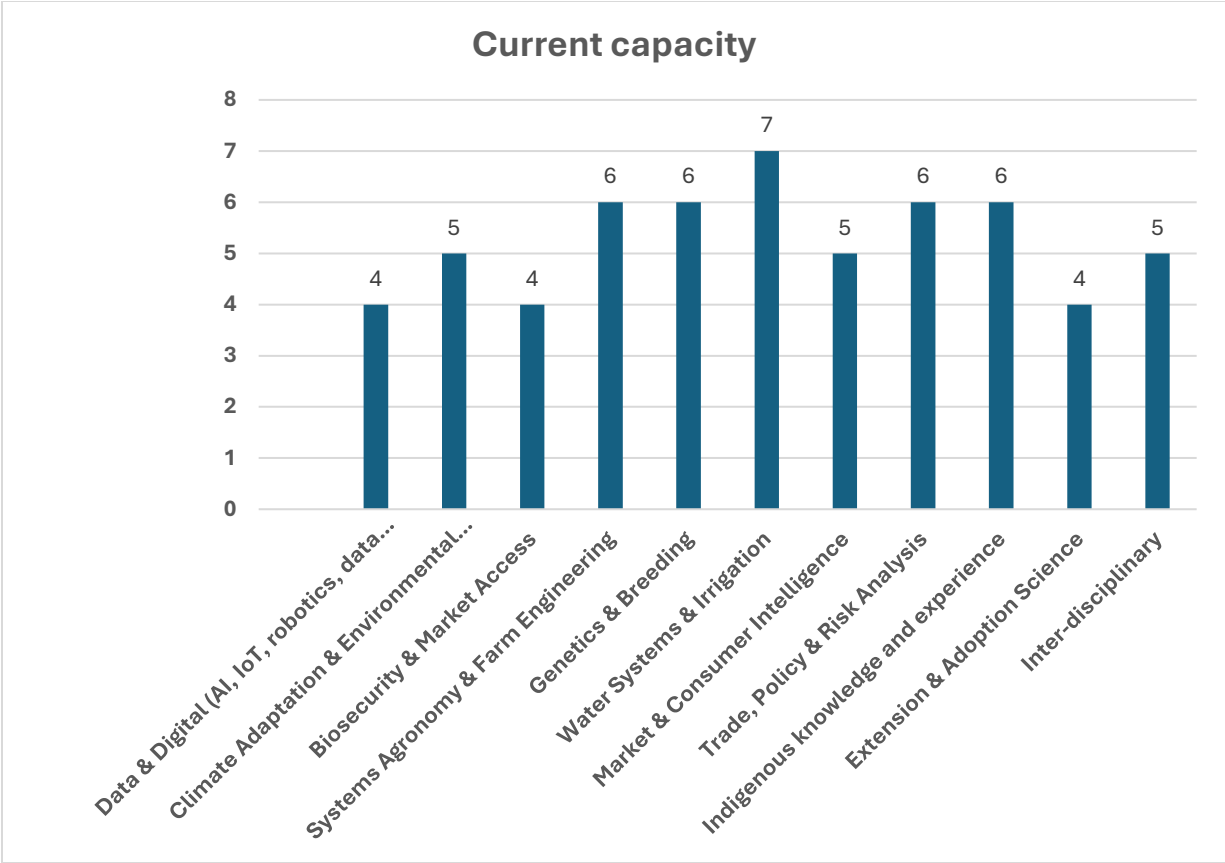


Figure 2. Current workforce capacity across RD&E theme areas

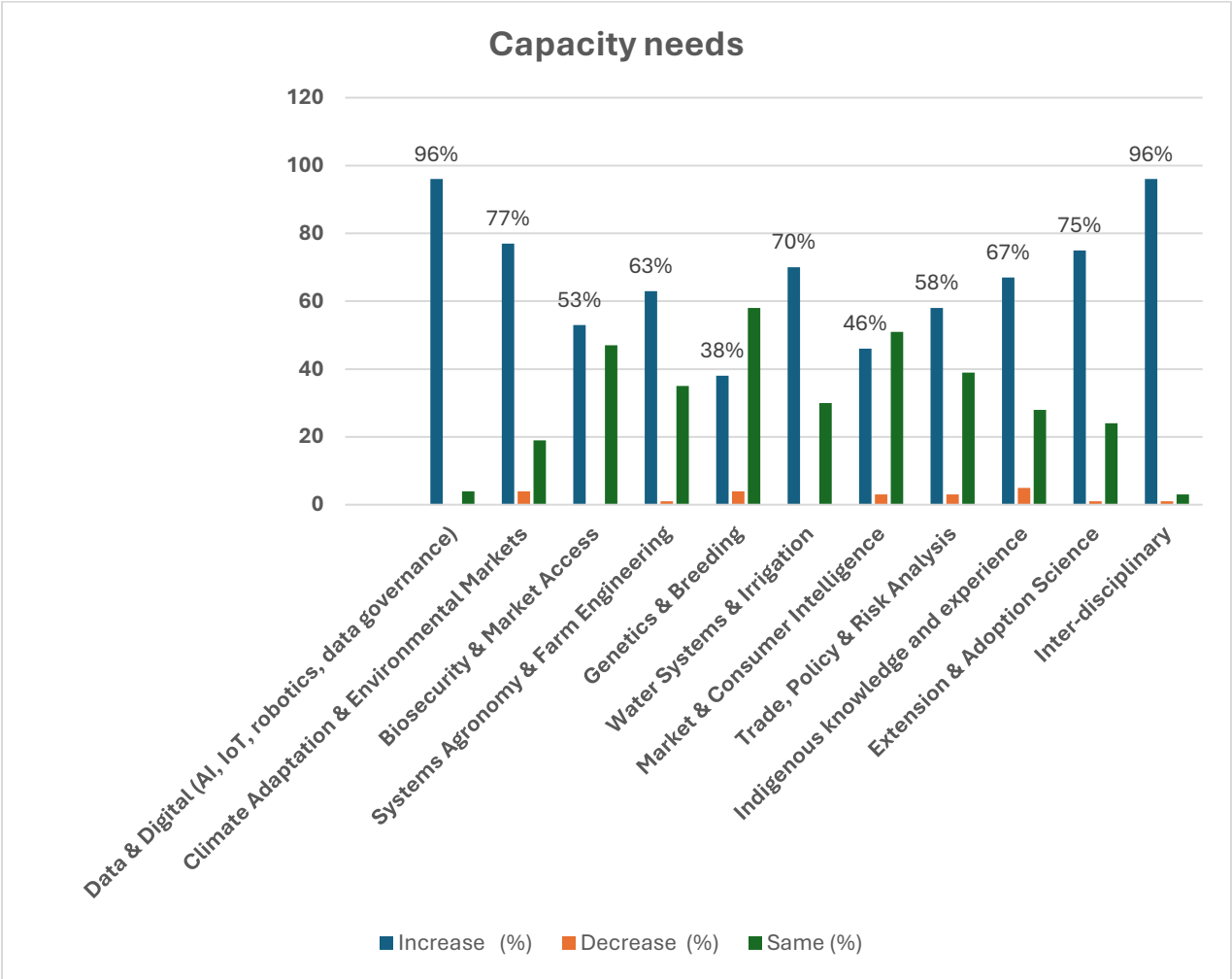


Figure 1. Workforce capacity needs across RD&E theme areas

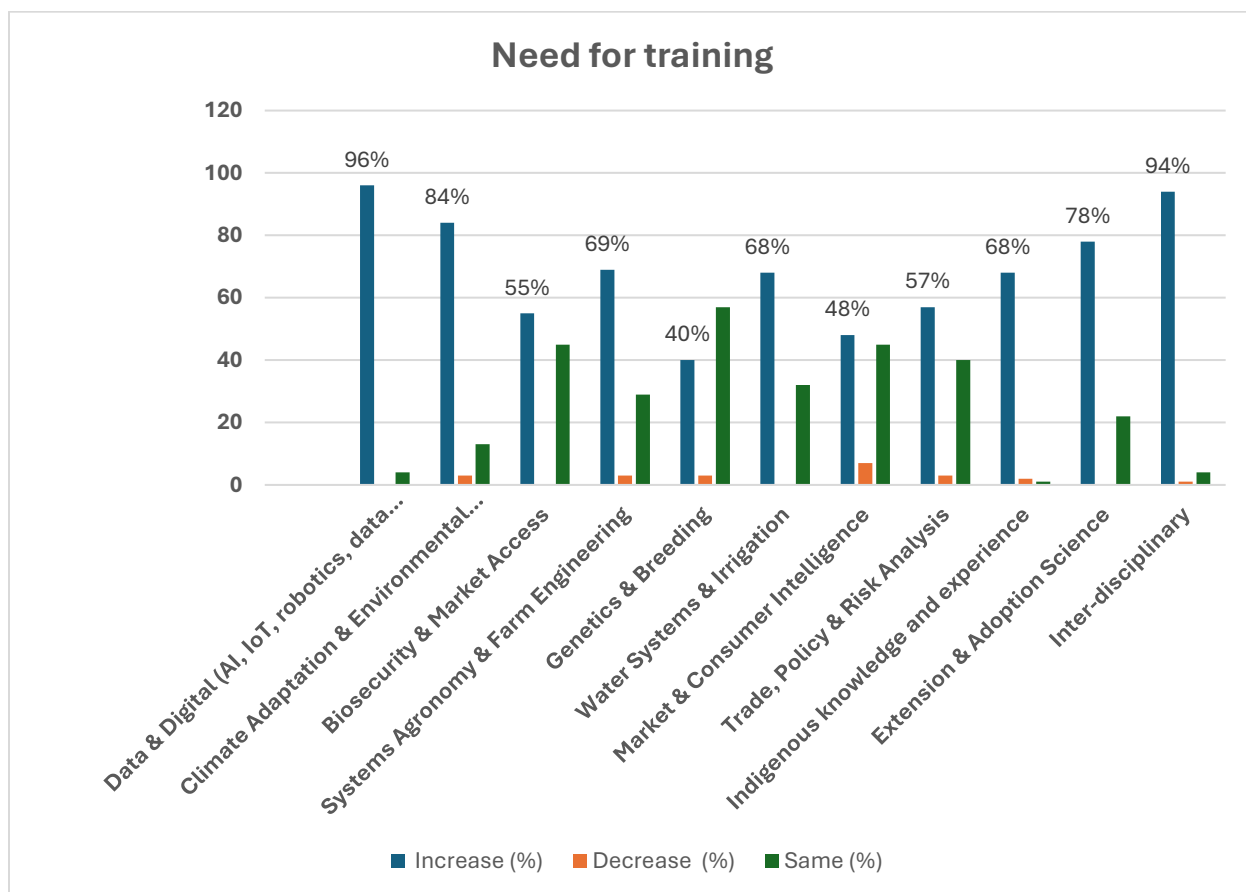


Figure 2. Training needs across RD&E theme areas

Appendix 3: Methodology for derivation of decline and improvement coefficients

Decline coefficients – ‘No-change’ scenario

The ‘No-change’ scenario represents a continuation of existing workforce trends without additional investment in recruitment, mentoring, or structured professional development. Under these conditions, discipline-specific capacity is assumed to decline each year due to retirement, competition from other sectors, and the gradual erosion of specialised expertise.

The annual decline coefficient was modelled as:

$$\Delta C = -(0.03 + 0.12 \times \text{Capacity Gap Index (norm)})$$

This structure represents a base deterioration of 0.03 points per year on a ten-point capacity scale, intensified in proportion to the size of the existing gap. The proportional term captures the greater vulnerability of disciplines already experiencing shortages.

This parameterisation reflects evidence that science and technical workforces typically experience 1–3 % annual net capacity loss in the absence of active renewal or succession planning (OECD 2023). Similar patterns are reported across public research agencies in Australia, where workforce ageing and competition from industry contribute to a gradual contraction of expertise (CSIRO 2020). Together these studies justify a conservative annual decline equivalent to ~0.1–0.3 points per year on a ten-point scale, consistent with observed trends in comparable RD&E systems.

Improvement coefficients – ‘Targeted investment’ scenario

The ‘Targeted investment’ scenario models a structured approach to workforce renewal through focused recruitment, training, mentoring, and career-pathway development. Annual improvement coefficients were derived from empirical outcomes of national RD&E and public-sector science capability programs.

During the initial investment phase (Years 1–5), annual improvement in discipline capacity was modelled as:

$$\Delta C = 0.08 + 0.22 \times \text{Training Gap Index (norm)}$$

This equates to an average increase of 0.1–0.3 points per year on a ten-point scale, producing a total gain of approximately 1–1.5 points over five years in disciplines with the most critical training deficits. From Year 6 onward, improvement was tapered to:

$$\Delta C = 0.03 + 0.07 \times \text{Training Gap Index (norm)}$$

This taper reflects consolidation as recruitment pipelines mature and marginal returns from training diminish. The resulting curve achieves long-term asymptotic limits (~8–8.5 / 10) and avoids unrealistic exponential growth.

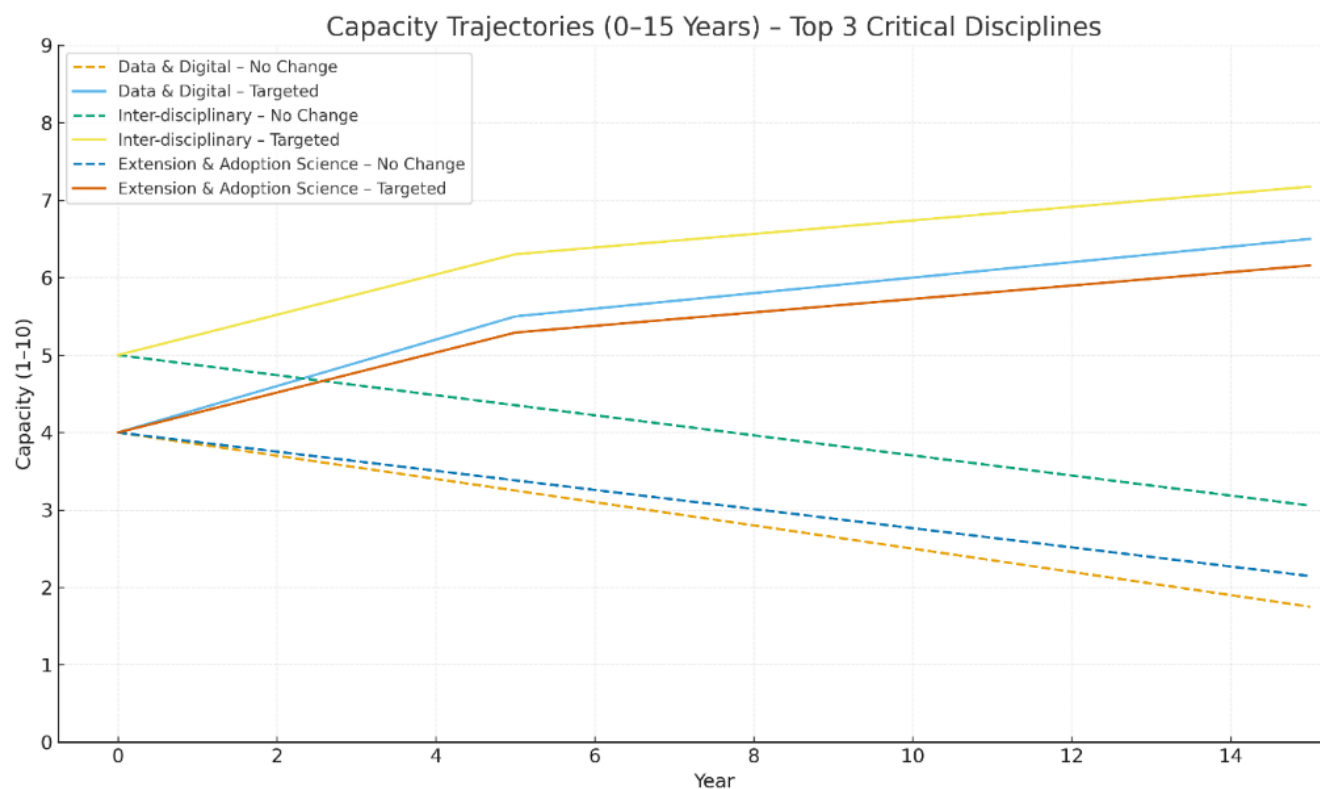
These coefficients are consistent with empirical observations from:

- GRDC's RD&E 'Capacity & Ability' investments (evaluated in Right-Sizing GRDC RD&E Investment, ACIL Allen 2025), which report measurable competency gains of 1–1.5 points over five years among targeted cohorts.
- OECD (2023) and UKRI (2021) workforce evaluation frameworks, which document early 'step-change' improvements followed by slower growth as systems stabilise.
- UNESCO (2021) global science workforce analyses, which show diminishing marginal returns beyond the initial planning cycle.

These rates are broadly aligned with international empirical benchmarks for public-sector RD&E systems and provide a conservative yet realistic foundation for the 0-15 year capacity projections as illustrated in Appendix 4.

Appendix 4: Future capacity trajectory predictions

Appendix 4 presents capacity trajectories for the next 15 years for the top three disciplines: Data and digital, Inter-disciplinary and Extension and adoption science – under no change and targeted scenarios,



Appendix 5: Methodology for succession risk matrix

The succession risk matrix was (Section 7.5) was developed by synthesising quantitative and qualitative data from the sector-wide survey findings.

Respondents identified disciplines and specialist areas at greatest risk of capacity loss due to ageing experts, limited recruitment, or weak training pipelines.

Each discipline was assessed against three criteria:

1. **Age Profile / Pipeline Strength** – derived from survey commentary on workforce demographics, mid-career representation and student inflows.
2. **Criticality to RD&E Outcomes** – rated according to each discipline's role in underpinning WA's agricultural innovation, adoption and biosecurity outcomes.
3. **Succession Vulnerability** – based on evidence of mentoring availability, ease of replacement, and concentration of expertise within few individuals or institutions.

A composite Succession Risk Level was then assigned using a qualitative risk ranking approach (Extreme → High → Moderate → Low), reflecting both the *likelihood of capacity loss* and the *impact of that loss* on RD&E performance.

Findings were validated against cross references to professional development priorities (Section 6.2) and the capacity heat map analysis (Section 6.3). The resulting matrix provides a structured overview of where WA's RD&E system faces the greatest continuity risks and where targeted mentoring, recruitment and investment will have the most immediate benefit.

Appendix 6: Survey findings reviewed against WAARC's six program areas

Program 1: Northern Agriculture

Focus area / theme	Evidence from literature review	Evidence from survey findings
Climate-smart intensification & adaptation	Need for climate-smart intensification, climate modelling, low-emission irrigation systems, adaptation for beef and irrigated cropping.	77–84 % of respondents want increased capacity/training in <i>Climate Adaptation & Environmental Markets</i> . Comments highlight 'thin and fragmented' regional expertise.
Water systems & irrigation	Capacity gaps in hydrology, irrigation engineering, groundwater recharge, recycled water use, and catchment-scale planning.	70 % want capacity and 68 % training increased. Comments note a shortage of <i>irrigation and water-resource experts</i> for Ord, Fitzroy and Carnarvon regions.
Biosecurity for tropical pests & diseases	Highlights biosecurity for tropical pests, rapid diagnostics, mobile surveillance systems, and cross-commodity biosecurity.	Moderate current capacity (4/10); 53–55 % want increases. Respondents warn of limited diagnostic coverage 'north of Geraldton.'
Digital & automation for remote systems	Prioritises edge computing, IoT connectivity, automation for remote contexts, and data-driven intensification.	96 % want increased Data & Digital capacity/training, the highest of all areas. Respondents note need for <i>field-ready digital engineers and drone operators</i> .
Extension & culturally capable workforce	Calls for <i>culturally capable extension</i> and local delivery capacity.	75–78 % want more extension capacity/training. Repeated mention of need for <i>trusted, regionally embedded facilitators</i> and <i>Indigenous engagement expertise</i> .
Regional workforce & succession	Mentions need for regional trial hubs and applied technical workforce.	Survey cites 'critical shortage of operators to run on-farm trials' and lack of mid-career staff willing to live regionally.
Indigenous partnerships & stewardship	Promotes <i>Indigenous-led research</i> on native foods, water stewardship, and biodiversity.	67–68 % call for increased Indigenous knowledge capacity/training; respondents highlight under-developed engagement frameworks.

Program 2: Grains Transformation

Focus area / theme	Evidence from literature review	Evidence from survey findings
Resilient rotations & systems agronomy	Lift productivity via systems approaches (amelioration, rotations, mixed farming).	Agronomy & production systems ranked #3 overall, with 63–69 % of respondents calling for increased capacity and training. Comments emphasised shortages of skilled agronomists and on-farm trial technicians, and the need for ‘applied farming-systems specialists able to connect research with local realities.’
Soil function & amelioration	Deep expertise in soil physics/biology; need scalable amelioration packages.	Soil, water & biogeochemical systems featured in 9 % of human-capacity priorities, with ≈70 % wanting more capacity/training. Respondents described an ageing soil science workforce and ‘loss of field-based expertise for amelioration and nutrient management.’
Genetics & climate resilience	Breeding for heat/drought/disease resilience and quality traits.	Genetics & breeding recorded 38–40 % wanting capacity/training increases. Respondents cited ‘strong legacy programs but few new breeders,’ limited gene editing skills, and the need for pathology integration.
Digital grains & decision support	Standardised data, edge analytics, validation platforms.	Data & digital was the #2 (Table 5) capacity priority, with 96 % wanting increases. Many highlighted ‘limited data-governance and analytics skills’ and the need for digital integration in grains RD&E.
Biosecurity & diagnostics	Maintain market access; rapid detection of pests/diseases.	Moderate current capacity (4 / 10) but 53–55 % want increases. Respondents warned of ‘thin diagnostic coverage’ and a shortage of plant pathology and pest diagnostics expertise in WA.
Post-farm gate & provenance/MRV	Quality, traceability, sustainability metrics for markets.	Market & consumer Intelligence capacity rated 5 / 10, with 46–48 % wanting increases. Comments pointed to ‘limited MRV and sustainability-reporting capacity’ and weak value-chain data integration.

Program 3: Resilient Agricultural Futures

Focus area / theme	Evidence from literature review	Evidence from survey findings
Climate adaptation planning	Region specific adaptation, risk economics.	77–84 % of respondents want increased capacity and training in Climate adaptation & environmental markets. Feedback described ‘thin and fragmented regional expertise’ and a shortage of people who can translate climate risk into business decisions.
Environmental markets & MRV	Build MRV for carbon/biodiversity; governance capacity.	Same 77–84 % support expansion; respondents noted confusion about carbon and biodiversity markets and called for ‘carbon-literacy and MRV skills’ to build confidence and avoid poor-quality schemes.
Drought & water security	Scenario planning; landscape water interventions.	Water systems & irrigation capacity rated 7 / 10 but 68–70 % want increases. Respondents cited hydrology and irrigation engineering shortages, especially for northern and inland projects.
Supply-chain & trade resilience	Stress-tests, logistics & export risk analysis.	Trade/policy & risk analysis: 58 % want capacity ↑ and 57 % training ↑. Participants highlighted limited modelling and policy translation expertise in WA and dependence on eastern-states analysts
Cross-sector biosecurity	One-health & cross-commodity frameworks.	Biosecurity & market access capacity 4 / 10; 53–55 % want increases. Comments emphasised ageing staff and lack of coordination across sectors.
Behavioural science for adoption	Embed behaviour, co-design, evaluation.	Behavioural & social science noted by 2 % of respondents but strongly referenced within extension feedback: ‘Need people who understand behaviour change and adoption processes.’ Seen as integral to resilience and risk-management delivery.

Program 4: Agricultural Technologies

Focus area / theme	Evidence from literature review	Evidence from survey findings
Automation & robotics	Priority for labour-scarce systems; need validation in WA contexts.	Data & digital was the highest area rated for growth (96 % want capacity/training ↑). Respondents asked for 'independent validation of robotics and automation' and practical training for field deployment.
Sensing & imaging (UAV/RS)	Scalable phenotyping & landscape monitoring.	Technical support responses repeatedly mentioned 'image-based analysis of crop, pasture and animal traits' and need for UAV operators and imaging specialists across industries.
Data governance & interoperability	Standards, APIs, cybersecurity, data rights.	Multiple comments called out 'fragmented datasets and no data-governance standards.' Respondents said WA 'leads in tech adoption but lags in data management.'
Edge/IoT connectivity	Remote operations require robust telemetry.	Participants noted 'poor network reliability in regional trials' and a lack of staff able to maintain IoT systems. Digital tech skills gaps seen as a barrier to precision ag adoption.
Human-centred design & usability	Make tools extension-ready and farmer-usable.	Respondents urged that 'tools be efficient and easy for use by farmers.' Extension specialists said usability testing and co-design are missing stages in most digital projects.
Digital extension skills	Data driven advisory practice.	Extension practitioners asked for training in 'data interpretation and communication.' The survey's professional development (PD) results ranked Extension & Communication and Data & Digital as second and third in priority, reinforcing demand for digitally literate advisors.

Program 5: Aboriginal Science Engagement

Focus area / theme	Evidence from literature review	Evidence from survey findings
Indigenous-led research & co-design	Prioritise Aboriginal leadership in native foods/fibres, land/water stewardship, fire.	67–68 % of respondents want increased capacity and training in Indigenous Knowledge & Experience. Many noted ‘under-developed engagement frameworks’ and limited inclusion of Aboriginal researchers in mainstream RD&E.
Pathways & workforce development	Scholarships, cadetships, on-Country training.	Diversity & Inclusion ranked low overall but comments emphasised ‘a need for genuine career pathways for Indigenous people in RD&E, not just short-term roles.’
Cultural capacity across RD&E	Lift cultural safety & partnership skills sector-wide.	Respondents across both extension and management roles said workplaces must ‘build cultural safety and cross-cultural facilitation skills.’ Linked to broader calls for inclusivity.
Indigenous knowledge in adaptation & NRM	Integrate burning, water, biodiversity knowledge with climate/MRV.	Climate-adaptation and soil/water comments referenced ‘traditional fire and water knowledge.’ Participants saw strong potential to connect Indigenous land management with adaptation programs.
Enterprise & markets	Support for Indigenous agribusiness development.	Fewer direct mentions, but some respondents pointed to ‘opportunities in native foods and seed industries’ and emphasised enabling Indigenous owned agribusinesses through RD&E partnerships.

Program 6: Capacity Building and Extension

Focus area / theme	Evidence from literature review	Evidence from survey findings
Extension and adoption science as core infrastructure	Build scalable, evidence-based extension; evaluation embedded.	Extension and communication ranked the #1 human capacity priority (table 5) with 75–78 % wanting capacity/training ↑. Respondents described it as ‘a critical bottleneck’ due to retirements and defunding.
Mentoring and workforce development	Structured PD across career stages.	The dominant PD theme (54 % of all PD mentions). Comments stressed ‘structured mentoring, coaching and succession planning’ as essential to attract and retain staff.
Regional delivery capacity	Embed roles outside Perth; travel-efficient models.	Respondents noted patchy coverage and ‘a great need for skilled operators to run on farm trials.’ Many called for regionally based extension hubs.
Inter-disciplinary integration	Join technical + social/economic science.	94–96 % want increases in inter-disciplinary capacity/training. Feedback described siloed research cultures and need for ‘people who can connect agronomy, economics and social science.’
Digital extension capacity	Data-literate advisors, tool usability.	The survey’s PD results ranked Extension & communication and Data & digital as second and third in priority, reinforcing demand for digitally literate advisors. Respondents asked for ‘training to translate data for practical decision-making.’
Career pathways & stability	Multi-year roles, clear progression.	Almost half rated current pathways not effective (49 %); salary and job security were top barriers. Comments highlighted ‘short-term contracts’ and ‘no clear advancement routes.’
Infrastructure & trial capacity	Modern facilities enable attraction & impact.	Repeated feedback on ‘ageing facilities’ and ‘decline in experimental field skills.’ Respondents urged investment in modern research farms and shared infrastructure to enable quality science and staff retention.

Appendix 7: Survey findings reviewed against DPIRD's strategic intent focus areas

DPIRD Strategic Intent focus area	Future RD&E needs and capacity requirements	Alignment with WA survey findings	Consequences of not investing	Consequences of investing
Dynamic regions & primary industries	Digital & automation across value chains; post-harvest value-adding; biosecurity integration; data governance and robotics testbeds.	Data & digital ranked #2 (96% want ↑). Strong overlap with Extension & Communication (#1). Biosecurity demand ~55%.	Lag in digital adoption, lower productivity vs competitors; biosecurity incursions threaten market access; missed diversification.	Productivity and resilience gains; improved traceability and premium access; early detection capacity maintained.
Management & stewardship of land and aquatic assets	Climate adaptation; low-emissions pathways; MRV systems; soil & water stewardship; circular economy integration.	Climate & Sustainability 77–84% want ↑; Water 70%; Systems Agronomy 63–69%.	Climate vulnerability persists; soil and water degradation; loss of market access for environmental credentials.	Climate-ready practices embedded; verified MRV unlocks environmental markets; improved WUE and soil health.
Capable & empowered communities	Extension science, adoption, co-design; Indigenous knowledge engagement; workforce and leadership pipelines.	Extension & Communication 75–78% want ↑; Mentoring & Workforce 54% PD demand.	Persistent research-practice gap; workforce attrition; reduced regional innovation capacity.	Improved adoption rates; stronger regional RD&E network; sustained talent pipeline and leadership development.

Appendix 8: Review of survey findings against megatrend needs

If current WA agricultural RD&E workforce capacity remains as described in the survey (limited digital integration, ageing workforce, under-resourced extension, fragmented collaboration), the system will not be able to fully respond to or leverage the megatrends identified in the literature review. Table 17 below reviews survey findings against megatrend needs, including implications if no action is taken. Table 18 describes justifications and expected outcomes from investment in identified megatrend need areas.

Table 17. Review of survey findings against megatrend needs

Megatrend (from Literature review)	Implications if no action taken	Current capacity from survey
Digital Transformation & Data-Driven Agriculture	WA will remain a technology <i>user</i> rather than an innovator; data fragmentation and lack of analytics will prevent real-time decision making and productivity gains.	'Data, Modelling & Digital' was top or second across all capacity and training measures; 96 % want more capacity/training; respondents described 'only a handful of staff' with strong digital skills.
Climate Change, Carbon Markets & Environmental Sustainability	Limited capacity to manage carbon accounting, adaptation and MRV systems will leave WA lagging behind national and international climate programs.	'Climate & Sustainability' ranked fourth; 77–84 % want increases; described as 'thin and fragmented.'
Consumer & Market Transformation	Traceability, provenance and post-farmgate innovation will stall; WA products risk losing premium markets that demand verified sustainability.	'Market & Consumer Intelligence' low priority (46–48 % want ↑); minimal post-harvest/quality expertise.
Global Competition & Technological Acceleration	Without interdisciplinary, entrepreneurial and extension skills, WA will fail to commercialise R&D and connect innovation to farms.	'Extension & Communication' ranked #1; 75–78 % want ↑ training; extension seen as 'critical bottleneck.'
Demographic & Workforce Shifts	Ageing specialists and few mid-career replacements will lead to loss of institutional knowledge.	Mentoring & Workforce Development ranked #1 PD priority (54 %); succession and mentoring 'desperately needed.'

Sustainability & Resource Efficiency (More-for-Less)	Skills shortages in soil, water, and systems agronomy will limit productivity gains and adaptation.	‘Soil & Water’ mid-tier (≈70 % want ↑); shortage of field technicians and systems agronomists noted.
Biosecurity & One-Health Risks	Cross-sector surveillance and response capacity inadequate for new pest/disease pressures.	‘Biosecurity & Market Access’ moderate capacity (4/10); 55 % want ↑ training; ageing diagnostic workforce.

Table 18. Investment to manage and leverage the megatrends

Investment area	Justification (evidence from survey plus literature review)	Expected outcome
1. Digital & align with the top 5 priorities identified for building RD&E capacity and the top 5 priorities for attracting and retaining skilled people Data Capacity	Both sources identify digital transformation as the cornerstone of future RD&E. Survey: 96 % want ↑ capacity/training. Literature: AI, robotics, edge computing, interoperability as megatrend.	Develop a state-wide ‘Digital Agriculture Hub’ focusing on data governance, analytics, and applied AI.
2. Climate Adaptation, Carbon & Environmental Markets	Survey: climate & sustainability fourth priority; literature: climate adaptation and environmental services are central to future competitiveness.	Build climate-ready RD&E teams skilled in carbon literacy, MRV, adaptation design, and policy integration.
3. Extension, Communication & Adoption Science	Both stress need for knowledge translation to capture value from innovation.	Re-establish extension as core RD&E infrastructure: co-design, adult learning, behavioural science, digital extension.
4. Workforce Development, Mentoring & Succession Systems	Ageing workforce is cross-cutting risk; both reports cite missing mid-career and mentoring systems.	Long-term programs for graduate entry, mentoring, and fellowships; continuous learning culture.
5. Interdisciplinary & Systems Integration	Literature identifies convergence of digital-climate-market drivers; survey shows 96 % want ↑ cross-disciplinary capacity.	Fund boundary-spanning roles and integrative research centres linking social, economic, and technical sciences.
6. Regional Infrastructure & Research Hubs	Literature: regional innovation ecosystems; survey: ageing facilities, weak regional capacity.	Invest in modern, shared regional research centres with connectivity, housing, and partner employment support.

7. Cultural Capacity & Indigenous Knowledge Integration	Both highlight Indigenous land stewardship and cultural science as growth areas; survey shows 67–68 % want ↑ capacity/training.	Create Indigenous-led research partnerships and training pathways embedding cultural knowledge in NRM and adaptation.
8. Biosecurity & One-Health Systems	Global megatrend of rising transboundary pests; survey identifies ageing biosecurity workforce.	Strengthen diagnostics, data sharing, and cross-sector coordination (agriculture–environment–health).
9. Postharvest & Market Systems Innovation	Literature: consumer/market megatrend; survey: limited capacity post-farmgate.	Invest in value-chain R&D—traceability, quality assurance, and sustainable market development.