National Horticulture Research Network

National Primary Industries R D & E Framework

Horticulture Research Development and Extension Strategy

Focused and cohesive research, development and extension that underpins a vibrant and growing horticultural sector

2019-2024

The Horticulture Strategy of the National Primary Industries RD&E Framework has been developed by members of the National Horticulture Research Network.

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Executive summary

The Horticulture Research Development and Extension (RD&E) Strategy 2019-2024 (the Strategy) has been developed by the National Horticulture Research Network (NHRN) as part of its responsibilities under the National Primary Industries Research, Development and Extension Framework (the Framework). This strategy replaces the inaugural Horticulture RD&E Strategy developed by the NHRN in 2010.

The Framework recognises innovation and RD&E are key drivers of agricultural productivity and competitiveness. The Framework facilitates greater coordination between Commonwealth and State research agencies, industry and the tertiary sector. The purpose is to improve national research collaboration and reduce duplication of effort.

NHRN members include State and Commonwealth research agencies, and Horticulture Innovation Australia Ltd (Hort Innovation). These agencies build capability in fields strategically important to their jurisdictions and industries. The NHRN strives to ensure national capability for horticultural research is maintained for the benefit of industry, noting that some agencies may also withdraw capability in some areas that are not strategically relevant.

The Horticulture RD&E Strategy's vision is for focused and cohesive RD&E that underpins a vibrant and growing horticultural sector.

The NHRN has identified the following priority research areas for the life of this strategy:

- Genetic improvement
- Climate adaptation
- Advanced production systems
- Consumer insights and preferences
- Protected cropping
- Pollination capacity
- Market access and early market development
- Information and extension delivery systems.

Three objectives have been agreed as mechanisms to meet obligations under the Framework while ensuring relevant RD&E for the benefit of industry:

Objective 1: Build, maintain and monitor RD&E capability for the benefit of Australian horticultural industries.

Objective 2: Provide a forum for agencies to ensure coordination and collaboration of national RD&E to meet Framework objectives.

Objective 3: Provide strategic research leadership in horticulture, providing research pathways and high-level technical advice to industry to ensure optimal RD&E outcomes.

Introduction

The Australian horticulture industry is one of the largest and most diverse industries in Australian agriculture, with gross value of production forecast at $11.7 billion in 2019-20.

Underpinning the continued success and future growth of Australia's horticultural industries will be research, development and extension (RD&E) that supports innovation, productivity, and sustainability. To maximise scarce resources for industry benefit, RD&E investment must be focussed to ensure efficiency, effectiveness and collaboration while avoiding duplication of effort.

National Primary Industries RD&E Framework

In April 2005, the Primary Industries Ministerial Council (PIMC) endorsed the concept of 'National R with Regional D&E'. This concept improves the efficiency and effectiveness of the national RD&E capability through cooperation between Commonwealth and State research agencies and industry. In April 2007, the PIMC agreed to develop a national RD&E Framework as a broad national plan to provide a more comprehensive, structured approach.

The Australian, State and Northern Territory Governments, rural R&D corporations, CSIRO, and universities are jointly implementing the Framework to encourage greater collaboration and promote continuous improvement in the investment of RD&E resources nationally. Under the Framework, primary industries RD&E is now more coordinated and collaborative, national research capability is better focused and used efficiently and effectively to achieve the best outcomes and uptake by primary industries. In 2014, arrangements were made to streamline the ministerial council system and the new Agricultural Senior Officials Committee (AGSOC) was introduced as the principal coordinating body.

The Framework spans 14 primary industry sector strategies and seven cross-industry sector strategies. These are:

Primary industry sectors
Beef, cotton, dairy, fisheries and aquaculture, forests, grains, horticulture, pork, poultry, sheep meat, sugar, wine, wool, and new and emerging industries.

Cross-industry sectors
Animal biosecurity, animal welfare, biofuels and bioenergy, climate change and variability, food and nutrition, plant biosecurity, soils, and water use in agriculture.

More information about the Framework can be found on the Research Innovation Committee website.

A Statement of Intent was developed to capture the intention of all parties to work collectively and collaboratively to develop and implement the Framework, and the underpinning national sector and cross-sector RD&E strategies. The first Statement of Intent was signed in June 2009. Following an independent review of the Framework in 2012, a second version of the Statement of Intent was released in 2017 which reaffirms the commitment to the Framework and takes into account the findings of the review and relevant RD&E policies that have been developed since 2009.

Horticulture RD&E Strategy

The National Horticulture Research Network (NHRN) is responsible for developing and implementing the National Horticulture RD&E Strategy (the Strategy) under the Framework. The NHRN's membership includes representatives from State and Commonwealth research agencies, and Horticulture Innovation Australia Ltd (Hort Innovation). The Commonwealth Department of Agriculture and Water Resources is an observer on the NHRN. A current list of NHRN members can be found on the NHRN website.

The original Horticulture RD&E Strategy was published in 2010. Since then a number of horticulture's structural, industry and policy arrangements have changed making it timely to review the Strategy. The most notable of these is the transition of Horticulture Australia Ltd to the grower-owned company, Horticulture Innovation Australia in October 2014, with a resulting change in funding and governance arrangements.

The Strategy has been updated to reflect these changes and responds to a number of challenges and opportunities that face Australia's horticultural industries.

Overview of the Australian horticulture sector

Horticulture is Australia's third largest agricultural industry, with a gross value of production forecast at $11.7 billion in 2019-20. The outlook beyond 2018 suggests increased fruit and nut production will grow horticulture's value.

The horticulture industry is grouped into the following broad product categories:

- fruits
- vegetables
- nuts
- nursery, cut flowers and turf.

The majority of production occurs on small-scale, family-owned farms. However, larger scale operations are becoming increasingly common, driven by cost-efficiencies and streamlined supply chain arrangements. There are approximately 30,000 horticultural businesses that employ an estimated 63,000 people throughout Australia.

Major Australian growing regions include:

- Goulburn Valley (Victoria),
- Murrumbidgee irrigation area (New South Wales),
- Sunraysia district (Victoria and New South Wales)
- Riverland region (South Australia) and
- Bundaberg (Queensland)

Major production also occurs in southwest and northwest Western Australia, and in the tropical north (Queensland and Northern Territory).

Approximately 60 per cent of fresh production is sold domestically, while exports totalled around $2.66 billion in 2016-17. Major export markets include Asia, the Middle East and New Zealand. Export success is primarily driven by favourable market access arrangements and a “clean and green” reputation built on rigorous production standards. Industries that benefit from improved market access are expected to grow at a faster rate than those that are more reliant on the domestic market.

Australian Government
Department of Agriculture and Water Resources
ABARES

Outlook for horticulture

	unit	2016–17	2017–18 s	2018–19 f	2019–20 f	2020–21 z	2021–22 z	2022–23 z	2023–24 z
Gross value									
nominal	$m	10,459	10,678	11,314	11,657	12,021	12,511	12,922	13,306
real **a**	$m	10,885	10,902	11,314	11,400	11,470	11,646	11,735	11,789
Fruit and tree nuts (excl. grapes)									
nominal	$m	4,234	4,470	4,990	5,176	5,369	5,655	5,883	6,078
real **a**	$m	4,406	4,564	4,990	5,063	5,123	5,264	5,343	5,385
Table and dried grapes									
nominal	$m	504	510	530	553	589	658	705	753
real **a**	$m	525	521	530	541	562	613	640	667
Vegetables									
nominal	$m	3,904	3,850	3,916	4,019	4,124	4,228	4,335	4,445
real **a**	$m	4,063	3,931	3,916	3,930	3,934	3,936	3,937	3,938
Nursery, cut flowers and turf									
nominal	$m	1,572	1,599	1,625	1,652	1,678	1,704	1,731	1,757
real **a**	$m	1,636	1,632	1,625	1,615	1,601	1,587	1,572	1,556
Other horticulture **nei b**									
nominal	$m	245	249	253	257	261	265	269	273
real **a**	$m	255	254	253	251	249	247	244	242
Exports									
nominal	$m	2,561	2,740	3,011	3,163	3,418	3,699	3,987	4,291
real **a**	$m	2,665	2,798	3,011	3,093	3,261	3,443	3,620	3,802
Fruit									
nominal	$m	1,086	1,241	1,298	1,336	1,437	1,554	1,668	1,786
real **a**	$m	1,131	1,267	1,298	1,306	1,371	1,446	1,515	1,582
Tree nuts									
nominal	$m	820	803	974	1,072	1,179	1,297	1,426	1,569
real **a**	$m	853	819	974	1,048	1,125	1,207	1,295	1,390
Vegetables									
nominal	$m	354	377	434	469	506	547	591	638
real **a**	$m	368	385	434	459	483	509	536	565
Nursery									
nominal	$m	19.2	17.5	16.6	16.0	16.8	17.2	16.9	16.7
real **a**	$m	20.0	17.9	16.6	15.7	16.1	16.1	15.3	14.8
Other horticulture **b**									
nominal	$m	281	303	287	271	279	284	285	281
real **a**	$m	293	309	287	265	266	265	259	249

a In 2018–19 Australian dollars. **b** Other horticulture includes mainly coffee, tea, spices, essential oils, vegetables for seed and other miscellaneous horticultural products.
f ABARES forecast. **s** ABARES estimate. **z** ABARES projection.
Sources: ABARES; Australian Bureau of Statistics

Source: ABARES (2019) *Agricultural Commodities: March 2019*, Canberra, ACT pg 57

Opportunities and challenges

The Australian horticultural industry faces a number of opportunities and challenges, including:

China

Demand from China for Australian horticultural products continues to grow. This is in part due to the reputation of Australian produce as safe, as well as rising disposable incomes in China, improvements in tariff arrangements, shipping efficiencies and favorable exchange rates.

However, Australia does face competition in China most notably from Chile where large scale fruit production (particularly blueberries, cherries, nectarines, peaches, plums and table grapes) enables larger volumes into China. In 2019, Chile is seeking access to China for citrus. In the medium term, as China and Chile continue to expand their trading relationship through market access arrangements and protocols, it is expected that Australia's fruit exports to China will slow.

Traceability
Increasingly important to horticulture, traceability provides confidence to consumers about the safety, quality, provenance and sustainability of the produce they buy. In 2019, the Australian government is leading a cross-jurisdictional working group aimed at enhancing Australia's traceability systems. Continued access to export markets will be dependent on Australia's ability to demonstrate rigorous traceability systems that comply with import market requirements.

In the domestic market, traceability standards have been harmonised with a view to reducing compliance costs. Food safety incidents in horticulture during 2018 make it critical to ensure industry can balance costs with consumer expectations.

Labour
Horticulture is Australia's most labour intensive agricultural industry, accounting for around a third of primary agricultural employment. Access to labour continues to be a challenge for many horticultural businesses, despite a number of programs designed to support industry.

Climate
A changing climate will put pressure on existing growing areas. In 2018-19 horticultural production was impacted by both droughts and floods. An increase in weather unpredictability may make broadacre production more volatile in some growing areas.

Limited access to irrigation water in the Murray-Darling Basin during 2018-19 impacted horticulture's expansion opportunities, and some growers were priced out of the market by historically high water prices. Policy developments in the Murray-Darling Basin are continually evolving, resulting in production uncertainty in growing regions.

Biosecurity
Reducing the threat of pest and disease incursions is a high priority for the horticultural industry. Maintaining Australia's reputation of a supplier of pest and disease free produce is critical to market access and provides new opportunities for Australian exports. From a production perspective, the costs of control or eradication on farm profitability, make preparedness and awareness a priority.

Horticulture RD&E operating context

The 2010 Strategy has delivered the Framework's objectives to develop and maintain coordinated RD&E at a government agency level, reducing duplication and thereby increasing impact. However, since the development of the last Strategy in 2010, several new arrangements need to be considered to ensure the continuation, and enhancement, of RD&E collaboration and cooperation, including:

- Hort Innovation's funding model and governance arrangements have changed with the transition to a grower-owned, not-for-profit company, Horticulture Innovation Australia Ltd (Hort Innovation) in 2014.
- Peak industry bodies' influence on Hort Innovation project funding has declined, and a new structure incorporating Strategic Investment Advisory Panels (SIAPs) has been introduced, which provide for a broader industry representation in decision-making.
- The number of private sector research and extension providers in horticulture RD&E has increased, as has the RD&E effort in Australian tertiary institutions. This creates some complexity in long-term planning as an increasing, new and diverse number of research providers require consideration in the RD&E collaboration and cooperation effort.
- At a State level, there is a stronger focus in aligning R&D investment with State economic development goals, rather than agency-led, industry development goals.
- The increasing prevalence of cross-sectoral strategies under the Framework requires progressively more input from industry strategies to ensure the alignment of goals and continued management to avoid duplication of effort.
- The number of reviews into research structures in Australia suggest the model needs refreshing.

Horticultural research arrangements

Horticultural research in Australia is undertaken by a range of providers, including State and Commonwealth agencies, tertiary institutions and private sector companies and research providers. Most horticultural research is coordinated through Hort Innovation.

Horticultural industries drive RD&E efforts by determining their research priorities and developing Strategic Investment Plans (SIPs), investment roadmaps that guide Hort Innovation investment. The SIPs for all Australian horticultural industries are available on the Hort Innovation website.

Horticulture Innovation Australia Ltd (Hort Innovation)

Hort Innovation is a not-for-profit, grower-owned company that invests producer and government funds to assist Australian horticulture through research, development, extension and marketing activities. More than 50 levies are collected across 34 commodities, and Hort Innovation invested more than $102 million in 2017-18.

In 2019, Hort Innovation released its new Strategy 2019-2023, with three strategic pillars underpinning their investments:

- Drive knowledge and innovation into horticulture industries.
- Deliver the highest value R&D, marketing and trade investments across industries now and into the future, and
- Enable activities that drive all strategic imperatives.

Hort Innovation is one of 15 Research and Development Corporations (RDCs) covering all of Australia's major agriculture industries. As an RDC, Hort Innovation can leverage industry levy investments in R&D with Commonwealth funds up to a value of 0.5 per cent of the industry's Gross Value of Production (GVP).

Hort Innovation operates two investment funds:

Strategic levy investment: These investments are funded by R&D levies and, where applicable, marketing levies from individual industries. Australian Government funds can be used to match R&D investments. The investments are industry-specific and are likely to have an investment timeframe of approximately one to five years. They tend towards applied R&D and align with a particular industry's strategic priorities. More information about Strategic Levy investments can be found on the Hort Innovation website.

Hort Frontiers: R&D investments are funded by contributions from co-investors leveraged with Australian Government funds. This mechanism allows Hort Innovation to actively seek co-investment in areas of strategic importance to Australian horticulture. Hort Innovation drives collaboration with both domestic and international co-investors from private enterprise, government agencies and the tertiary sector. The investments are likely to be large cross-industry investments with a higher risk profile or longer investment timeframe. More information about Hort Frontiers investments can be found on the Hort Innovation website.

National Horticulture Research Network (NHRN)

The NHRN was formed in 2001 as the senior national forum working in partnership with industry to plan and implement national RD&E programs for Australian horticulture. Its members include representatives from State and Commonwealth research agencies, and Hort Innovation. The Commonwealth Department of Agriculture and Water Resources is an observer on the NHRN.

Agency investment in horticulture RD&E has underpinned industry development for decades. At 30 June 2016, there were 366 full-time equivalent personnel engaged in horticulture crop RD&E in NHRN agencies, at 44 sites across Australia. In 2015-16, NHRN agencies invested $36.5m from core budgets in horticulture RD&E and leveraged a further $22.9m from government agencies and private sector organisations.

The NHRN's fundamental focus is growing and maintaining R&D capability and efficiency, to ensure the investment by agencies has high impact outcomes. The NHRN's objectives are:

- Plan and collaborate to deliver RD&E to horticulture industries through the Framework via a Strategy.
- Maintain relationships with industry to inform stated RD&E needs.
- Identify strategic long-term investments and priorities to grow and maintain existing industries.
- Monitor, communicate and develop national capability and provide advice, policies and programs to maintain capability.
- Provide advice to research providers and funders in relation to cross-sectoral priorities and project development and undertake R&D where relevant.
- Monitor and access alternative funding to achieve industry goals.

The NHRN has the responsibility for the development and ongoing delivery of the Strategy. NHRN's focus is on ensuring horticultural research is more efficient and that key capabilities of State and Commonwealth agencies align with industry's strategic needs.

The NHRN recognises that industries, through Hort Innovation, have responsibility for determining their research priorities. NHRN representatives support horticultural industries to determine their strategic research priorities by participating in Hort Innovation's Strategic Investment Plan processes, and by providing technical knowledge and support to the industry Strategic Investment Advisory Panels.

A National Horticulture RD&E Strategy

To drive collaboration and coordination of national horticultural research, the NHRN implements the Strategy in accordance with the Framework's priority outcomes:

1. Agencies retain/build capability in fields strategically important to them and, at the same time, cooperate with others to build their capability to provide for a more comprehensive national research capability.

2. Research capability is more collaborative, specialised, has larger critical mass and is less distributed across the nation. Efficiency and effectiveness of RD&E will be markedly improved overall. Some additional costs will be incurred in providing national linkages and to support the delivery of regional development and local extension.

3. The national research capability would be the 'discovery' component of a wider innovation agenda that spans and supports development and extension. Therefore, to facilitate rapid uptake of new technologies, research developed in one area of the country would be available in other regions where the same industry is located.

To develop the Strategy, the NHRN has sought to align research capacity and capability with research priorities, and emerging needs and opportunities within the range of horticultural

industries. The development of the Strategy has involved consulting with relevant collaborators to identify resource requirements and potential implementation issues. By ensuring the substantial resources invested by government and industry in research are managed cooperatively, a more efficient, effective and comprehensive capability will be possible.

Strategy research priorities

The Strategy's vision is for focused and cohesive RD&E that underpins a vibrant and growing horticultural sector. The key themes in determining strategic research priorities to meet that vision are:

- Redesigning the production system to deliver productivity and profitability
- Differentiating our market
- Building capability to better respond to environmental events and facilitate natural resource management.

These themes encapsulate the NHRN's approach to developing priorities for horticultural research and underpin the Strategy. They are developed in accordance with member agency investment and development objectives, aligned with industry priorities and Hort Innovation's funding model.

This Strategy will focus on the facilitation of larger, strategic and cross-jurisdictional projects that deliver major outcomes for the sector, and include:

Genetic improvement

Underpinning Australian horticulture success, is access to the best available genetic resources for crop production. Australia cannot solely rely on importing the best varieties from overseas, as they may not be adapted to local conditions and may not be available to all local producers.

The application of advanced molecular technologies for genetic improvement has the potential to provide world-leading varieties to underpin market access, farm productivity, future climate impacts and address a range of other challenges and opportunities. Beyond crop-specific improvements yielding new lines, discovery driven research methodologies such as genomics have utility beyond the life of any one project, and comparative genomics can benefit a range of species.

New methodologies could apply to either genetically or non-genetically modified plants.

Climate adaptation

Producers require an understanding of likely future regional climate impacts to develop adaptation strategies. Research is required to assist industries to understand climate variability and specific risks concerning crop phenology, better manage extreme heat events, frost, increased summer rainfall and insufficient chill, effectively using new advances in short-term weather forecasts to manage risks.

Another key component is the exploration and modelling of geographic diversity and the opportunity to spread the range of current cropping systems. The ability to be able to predict temperature more accurately for shorter-term time frames (6 to 12 weeks) will also be critical to enhance decisions with what vegetable varieties to plant.

Advanced production systems

Ultimately, understanding how to run productive and profitable horticultural enterprises will depend on the effectiveness of the production system, and identifying potential modifications to existing practices and systems. There are a range of areas where innovative approaches could improve Australian production systems including:

- Irrigation improvements
- Digital technologies
- Robotics/mechanisation as well as data and decision support
- Integrated Pest Management
- Uniform plant architecture to standardise harvest systems to reduce labour costs
- Addressing seasonal variability
- Plant resilience and sustainable productivity
- Using rootstocks to confer disease resistance, increase yields and improve quality
- Managing soil health to reduce reliance on fungicides and increase profitability
- Designing production systems that deliver “residue free” produce
- Developing viable organic alternatives to standard production systems
- Optimising protected cropping systems to decrease risk, increase quality and improve yields per square metre
- Productivity systems to deliver step changes in yields
- Minimising the impacts of biennial bearing and season to season yield variability
- Generating guidelines on how to engineer production systems to meet target market requirements.

Product traceability and integrity

Australia’s horticultural industries’ competitive advantage is quality and safety, which normally results in a premium return in market. Food safety issues in Australia in recent years highlight that this competitive advantage is not assured. Competitor countries are also developing traceability and integrity technology that improve their access to premium markets. This means that product integrity and product quality are of major importance and hence R&D in the areas of consumer and sensory science are becoming increasingly important.

Protected cropping

Consumers demand access to quality fresh produce 52 weeks a year. The challenges of climate variability and extreme weather events make it difficult for producers to plan for and ensure harvesting of high marketable yields that meet the increasingly stringent quality standards of the retail market. Yields of field-grown fruit and vegetable crops can be limited by extremes in solar radiation, air temperatures, wind speed, and rainfall. Biological constraints caused by insect pests

and insects transmitting plant viruses also limit marketable production and restrict access to markets.

Protected cropping systems present a set of complementary cost-effective climate-adaptive technologies to field-based growers who aim to supply high-value commodities to specific markets. They can act as a 'crop insurance' against adverse or suboptimal environmental conditions and also bring opportunities for increasing yields up to six times greater than in open field crops.

Pollination capacity

Pollination is an essential element of the plant (and food) production cycle and is a major contributor to the global economy. Pollination services have largely been accepted as freely and naturally available however this can no longer be taken for granted. Commercial honeybees provide an essential service in supplementing naturally occurring pollination services, but pests and diseases such as the *Varroa mite* are decimating bee populations around the globe. These now threaten Australia's feral and commercial honeybee populations. At the time of writing, Australia remains free of Varroa mite, but it is crucial that our pollination capacity is preserved and enhanced to sustain and improve agricultural production.

Market access and early market development

Assisting industry to develop a greater export culture, focussing on export rather than domestic markets and gaining and maintaining market access, both domestically and internationally, is critical to the long-term profitability of horticultural industries. It is an important area of research, the ramifications of which are not always fully understood by industry.

A range of research needs have been identified, including meeting importers' phytosanitary protocols and, having gained a practical access option, ensuring the ability to deliver the premium quality products sought in the market. The latter will require research to identify the varieties with flavour and nutrition profiles and apply post-harvest handling and treatments that deliver chain efficiency and effectiveness.

Phytosanitary protocol development must be developed in tandem with new market supply chain development activities to ensure protocols are commercially viable and ensure Australian product integrity and quality in target markets. The viability of all businesses in the chain must involve the capacity to successfully enter new markets and maintain a high profile of Australian product. A whole-of-chain research and development approach to new market access and maintenance is relevant across the industry where the learnings apply to all horticulture businesses and thus to enhance the reputation of Australian horticulture in export markets.

Information and extension delivery systems

It is generally acknowledged that extension is increasingly being offered by private providers and resources in State agencies are diminishing. At the same time, there is an increased producer appetite for the latest technologies to increase international and domestic competitiveness of horticultural enterprises in Australia.

Successful programs package and deliver information and knowledge in the way that the target audience requires and uses the information. Some particular sectors or regions will continue to prefer information delivery through personal contact, and co-investment into human resources to allow continued delivery by development staff should be supported.

In the same way, future information delivery systems will require research to utilise new platforms for a new generation of horticulture businesses and supply chain participants. It is envisaged an ever more distributed system will be needed with significantly enhanced capacity to satisfy requests for quality information. These needs can be met and delivered by partnerships, commercial producers, commercial consultants, and others who can value-add to horticulture businesses.

Implementation of the Strategy

To meet the Strategy's vision while delivering on Framework objectives, the NHRN has identified the following objectives to guide implementation:

Objective 1: Build, maintain and monitor RD&E capability for the benefit of Australian horticultural industries

Overview:

As signatories to the Framework, NHRN member agencies have committed to building and retaining capability in relevant disciplines to support horticultural RD&E aspirations that meet their jurisdiction's strategic needs. These disciplines are routinely reviewed to ensure they reflect horticulture's evolving needs. Capability, by discipline, is measured every three years in the Capability and Investment Analysis. The NHRN uses this data to develop a future capability needs report, that informs investments in RD&E capability. The NHRN maintains contact with several cross-sectoral strategies through the Framework leaders' forum, facilitated by the R&I Committee and has regular interactions with the Plant Biosecurity Strategy.

Relevant Framework outcomes:

- Research capability will more comprehensively and holistically cover the present and future strategic needs of stakeholders nationally.
- The parties will collaborate to retain and build capability in fields strategically important to their jurisdictions and industries.

Evaluation:

- Capability by discipline is monitored and measured every three years in the Capability and Investment Analysis.
- Any reductions in capability can be explained through agency or industry strategic imperatives and do not impact horticultural industries' RD&E.
- Future capability needs are being addressed by industry and government.

Objective 2: Provide a forum for agencies to ensure coordination and collaboration of national RD&E to meet Framework objectives

Overview:

The NHRN provides value to Australia's horticultural industries by ensuring effective coordination and collaboration in the national RD&E effort. The NHRN is the vehicle to communicate and raise awareness of RD&E activities and capability residing in the member agencies, ensuring efficient use of scarce human and financial resources. NHRN's delivery of Framework objectives means lower levels of duplication and higher levels of coordination among researchers, resulting in more efficient and effective research outputs with national impact and lower costs to industry.

Relevant Framework outcomes:

- To provide shared RD&E strategic direction and priorities for national and sector level primary industries in Australia that enhance the productivity and resilience of Australia's primary industries.

- Public research capability will become more integrated, interdependent and specialised, and have larger critical mass with less fragmentation across the nation.
- RD&E investment will improve the capability of the national system in priority areas and ensure effective and efficient use of resources, including infrastructure.
- The national research capability will be an integral component of a wider innovation agenda, supporting development and extension.

Evaluation:

- All agencies are represented at every NHRN meeting.
- All agencies provide written agency reports to each meeting.
- All lead agencies provide a Framework R&D update for their crops annually.
- Agencies report on investments that have contributed to behavioural change pre- and post- farm gate.
- Agencies host face-to-face meetings, with a focus on showcasing examples of research excellence in collaboration and coordination for the enhancement of national research outcomes.
- Coordination and collaboration is measured through the Capability and Investment Analyses and demonstrate an increase in co-investment in national research by agencies over time.

Objective 3: Provide strategic research leadership in horticulture, providing research pathways and high-level technical advice to industry to ensure optimal RD&E outcomes.

Overview:

NHRN provides a forum for strategic science responses to issues affecting horticultural industries. The Strategy research priorities underpin the work of each agency in progressing industry goals. While each research priority is monitored, each year, the NHRN identifies a priority area in need of targeted national coordination and collaboration. Agencies work with Hort Innovation to convene roundtables bringing relevant expertise and investment partners together to identify research pathways. In 2018, food safety was identified as the key research area. In 2019 and 2020, consumer insights and preferences, and protected cropping will be addressed through this process.

NHRN agencies also provide technical and scientific capability to industry Strategic Investment Advisory Panels (SIAPs) as required. SIAPs are charged with determining research priorities and investment decisions for each crop. The lead agency may be invited by Hort Innovation to nominate an officer with the relevant knowledge to add value to the process. This is not a representative role, rather a specialist, technical role.

Relevant Framework outcomes:

- Efficiency and effectiveness of RD&E will be improved and as a consequence returns on investment will improve.
- Research undertaken in one location will be developed and extended nationally for primary industries.

Evaluation:

- Strategic science issues are addressed through collaboration by NHRN agencies in identifying and coordinating relevant expertise and investment partners to create research pathways
- Where appropriate, SIAPs have input from the relevant lead agency for the industry.
- Industry and Hort Innovation value the participation by the agency's nominee, where relevant

RD&E capability and investment residing in NHRN agencies

The NHRN completed its fourth review into agency capability and investment applied to horticulture RD&E in 2015-16. The 2015-16 Capability and Investment Analysis captured data for 44 horticultural crops, across 24 disciplines in eight State and Commonwealth agencies (NHRN members). It captured capability by discipline applied to horticulture RD&E at 30 June 2016 and agency investment in horticulture RD&E for the 2015-16 financial year. Both investment and capability (expressed as Full-Time Equivalent staff numbers) have fallen since the last analysis undertaken for the 2012-13 financial year.

Historic trends in capability and investment applied to horticulture RD&E

	FTEs	NHRN investment
2015-16	366	$36.5
2012-13	467	$48.4
2011	496	[1]

The changes in capability and investment are driven by:

- Ongoing prioritisation of resources at an agency level to meet the objectives of the Framework.
- Government investment priorities that extend beyond agricultural RD&E to rural economic development, which has seen an increased focus on post-farm gate outcomes for some agencies.
- Agencies operating within a co-investment model that requires industry investment to deploy agency RD&E resources. Where industries do not invest in RD&E, agencies do not allocate human or financial resources.
- Evolution of RD&E priorities as industries mature, often to areas beyond the core business of agency RD&E functions, e.g. consumer research.
- Increasing consolidation and integration of the domestic supply chain.
- Growers using proprietary plant varieties (including from overseas) and are provided with RD&E from those companies.
- Increasing provision of research services by private sector providers

[1] No investment data was collected in 2011

Additionally, the restructure of Hort Innovation in the analysis year that may have delayed investment by some agencies as new processes and systems were implemented.

Strength through collaboration

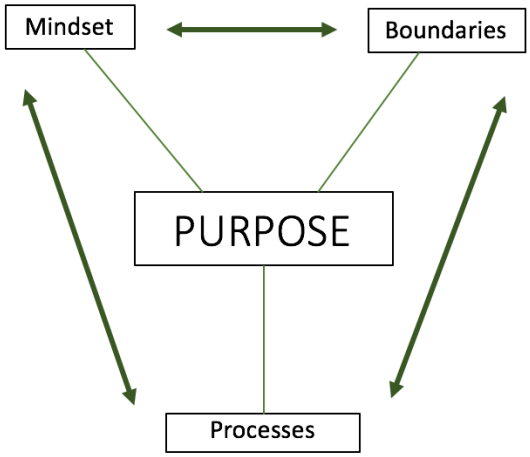
The NHRN operates in accordance with the goals of the Framework. Its purpose is to create greater collaboration and promote continuous improvement in the investment of horticulture RD&E resources nationally. This will deliver efficient and targeted outcomes for industry.

The NHRN achieves its purpose through:

Mindset: All NHRN members support national leadership and coordination of horticultural R&D and operate according to this principle.

Boundaries: Within the normal restraints of confidentiality and intellectual property rights held by jurisdictions, members endeavour to share information between agencies, with horticultural industries and with Hort Innovation for the benefit of the sector.

Processes: In delivering the Framework, NHRN agencies commit to develop, maintain and utilise research resources (infrastructure, equipment, human or other) collaboratively. Where appropriate, agencies develop joint programs to deliver a national project/program footprint. The NHRN meets four times a year (two face-to-face, two teleconferences) and members provide quarterly written updates on agency activities in horticultural RD&E. Lead agencies also provide an annual written report on the progress towards collaboration and coordination for each crop, which is distributed among the research community. The NHRN reports to the Research and Innovation Committee (R&I) of Agriculture Senior Officials Committee twice a year.



The collaboration model used by the NHRN in delivering the Strategy

The NHRN uses the Framework structure of major, support and link to deliver national leadership and coordination of horticultural R&D. Agencies nominate as major-support-link for each horticultural commodity and capture and align funding to collaborate to deliver industry R&D. The terms major, support and link, are defined as follows:

> **Major priority role**: This is a national leadership role where there is a major priority for the relevant government agency and they endeavoured to give a high priority to funding research, including infrastructure, for that sector.
>
> **Support role**: In this role, the relevant government agency undertakes research, but leadership and the major activity is provided by another government jurisdiction or party.
>
> **Link role**: In this role, the relevant government agency will undertake little or no research but access information and resources from other governments or parties to meet industry needs through D&E.

Horticultural industries seeking to progress RD&E priorities should contact the relevant major agency in the first instance to seek advice. The NHRN major, support and link responsibilities for each horticultural crop are available on the NHRN website.

Investing in RD&E to grow our industries

The focus for most State governments is building the competitive strengths of the state's economic drivers, of which agriculture may be one of many. Broadening investment to economic development outcomes has seen governments identify alternative ways to invest funds for regional benefit and statewide impact beyond agricultural research. Horticulture RD&E is still a focus for agencies, however, it tends to be included as part of wider investments in food businesses and the value chain, including market access.

Budget constraints and competing priorities across all portfolios mean agencies rely on industry investment to determine funding priorities in horticulture. Where industry can demonstrate their commitment to growth through co-investment of research funds, and where the RD&E required can be provided by agencies, investment and capability will be deployed to support that industry's goals.

As industries mature, their research needs evolve and will not necessarily be addressed by agencies. Established horticultural industries undertake significant work understanding consumer preferences and marketing, which may not be a core competency of all member agencies although it does exist. Growers using proprietary plant varieties (including from overseas) are provided with RD&E services by those companies. Consultants also provide these services and agencies accept that some industries prefer working with the private sector on their RD&E challenges.

Building and monitoring horticultural RD&E capability

The number of agency personnel allocated to horticulture RD&E is driven by several factors, including industry research needs being relevant to agency capabilities, industry co-investment and strategic capability goals set by agencies.

The NHRN has a role in ensuring horticultural research is more efficient, through reduced duplication and better coordination of the national research effort. The reduction of FTEs applied to horticultural RD&E is monitored by NHRN agencies to ensure capability can be deployed to meet industry needs.

Optimising research infrastructure

At 30 June 2016, there were 44 sites across Australia that are managed by NHRN agencies and which are dedicated to horticultural RD&E. This includes laboratories, glasshouse infrastructure and research farms. The following NHRN agencies manage these sites:

- Agriculture Victoria (AgVic).
- CSIRO.
- Department of Agriculture and Fisheries, Queensland (DAF).
- Department of Primary Industries and Regional Development, Western Australia (DPIRD)).
- Department of Primary Industry and Resources, Northern Territory (DPIR).
- New South Wales Department of Primary Industries (NSW DPI).
- South Australian Research and Development Institute (SARDI).
- Tasmanian Institute for Agriculture (TIA).

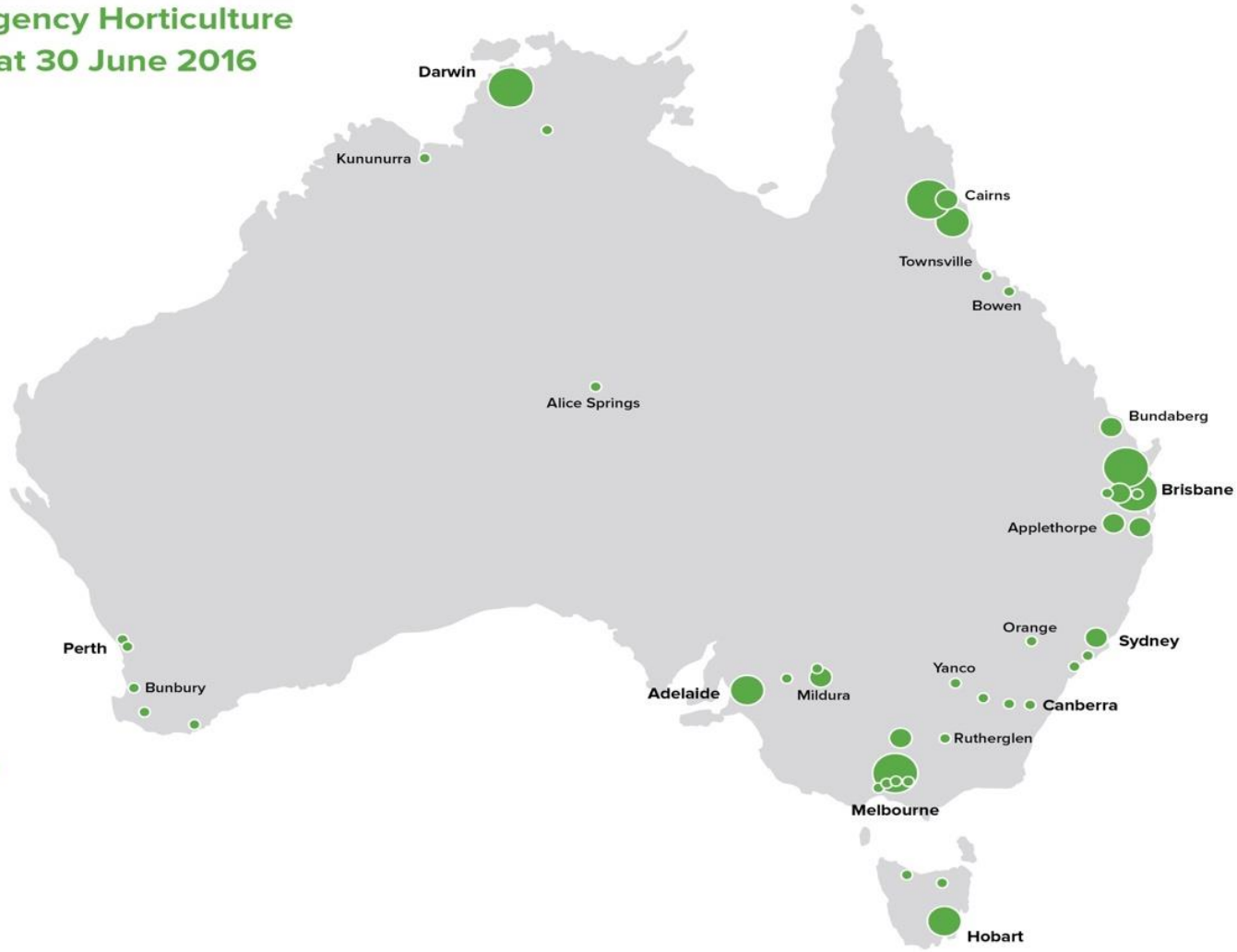
Other key centres of RD&E and research infrastructure are managed by:

- University of Western Sydney (National Vegetable Protected Cropping Centre)
- University of Sydney (Fresh Produce Safety Centre)

Location of NHRN Agency Horticulture RD&E Staff (by FTE) at 30 June 2016

- Up to 5
- 5 - 15FTE
- 15-20 FTE
- 20+ FTE

- Fruit
- Vegetables
- Nuts
- Lifestyle



New South Wales
Dareton
Menangle
North Ryde
Orange
Ourimbah
Tumut
Wagga Wagga
Wollongbar
Yanco

Northern Territory
Alice Springs
Berrimah
Katherine

Queensland
Applethorpe
Ayr
Brisbane
Bowen
Bundaberg
Cairns
Dutton Park
Gatton
Mareeba
Maroochy
South Johnstone
Toowoomba

South Australia
Adelaide
Loxton

Tasmania
Burnie
Hobart
Launceston

Victoria
Bundoora
Macleod
Mildura
Parkville
Rutherglen
Tatura
Wandin
Werribee

Western Australia
Albany
Bunbury
Kunnunurra
Manjimup
Perth
South Perth

ACT
Canberra