AgriFutures Honey Bee & Pollination Strategic RD&E Plan (2020-2025)
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AgriFutures Australia is the new trading name for Rural Industries Research & Development Corporation (RIRDC), a statutory authority of the Federal Government established by the Primary Industries Research and Development Act 1989.
AgriFutures Australia fosters strong relationships with industry partners, including the honey bee and pollination industry, to ensure RD&E investment leads to practical knowledge and innovation which can be adopted by industry members.”

Mr John Smith
General Manager, Research
AgriFutures Australia

Foreword

The AgriFutures Honey Bee & Pollination Program invests in research, development and extension (RD&E) to foster a productive, sustainable and more profitable Australian beekeeping industry and secure the pollination of Australia’s horticultural and agricultural crops.

The industry produces between 20,000 and 30,000 tonnes of honey annually, with approximately 5,000 tonnes exported across the world, and in a typical year 70% of Australian honey is produced from native flora.

While honey is the major commercial output of the honey bee industry, there are a number of other products that add to the income of honey bee businesses, including paid pollination services, beeswax production, and queen bee and packaged bee sales. In 2018/19, the Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES) determined the farm-gate value of the beekeeping industry as $129 million, while the unrecognised value of pollination is believed to be in the order of $14.2 billion (Karasiński, 2018). This relatively small Gross Value of Production (GVP) understates the industry’s value to agriculture and the economy in general through pollination services and, potentially, the value of honey and honey products in medical uses.

AgriFutures Australia industry-specific Strategic Plans are a key part of implementing the AgriFutures Australia Strategic R&D plan 2017–2022 and provide the basis for our Annual Operational Plan, guiding AgriFutures Australia’s investment on behalf of industry stakeholders. These Strategic Plans identify and balance RD&E priorities and outcomes to promote industry productivity, profitability and sustainability.

The AgriFutures Honey Bee and Pollination Strategic Plan 2020–2025 benefits from extensive industry consultation and external evaluation of previous research conducted over the past four years (2015–2019). The consultation was conducted over a one year period that included workshops, and engagement with levy payers and industry bodies.
Contents

Forward 05
What is a RD&E Strategic RD&E Plan 09

The Agrifutures Honey Bee & Pollination Program

Industry profile 12
Financial commitments 14
Reserces policy 14
RD&E program management 14
Mid-term evaluation of the Honey Bee & Pollination Strategic Plan 15
Communications plan 15
Evaluation of the Plan 15

Agrifutures Honey Bee & Pollination Program Strategic RD&E Plan (2020-2025)

Preparation of the Strategic RD&E Plan 18
Industry consultation for the Strategic RD&E Plan 18
Objectives and strategies 18

Objective: Identify and develop technology for improved hive performance 22
Objective: Increase capacity within research community and future industry leaders 23
Objective: Improve understanding of nutrition best practice and disease interaction 24
Objective: Improve understanding of the benefits of honey and develop chain traceability 25
Objective: Improve understanding of pollination strategies that impact crop yields and improve hive health 26
Objective: Improve understanding of floral resources as assets for the Australian honey bee industry 27

Appendices

Appendix 1: Agrifutures Honey Bee & Pollination Program Strategic Plan (2020-2025) 28
Appendix 2: Industry consultation – workshop Attendees 30
Appendix 3: Industry issues and opportunities 31

Glossary 32
Reference 33
Our vision

To grow the long term prosperity of Australian rural industries

1. **People and Leadership**
   - **Goal**: Support the people driving the future prosperity of Australian rural industries and regional communities by providing them with learning opportunities and experiences.
   - **Priorities**: Attracting capable people into careers in agriculture.

2. **National Challenges and Opportunities**
   - **Goal**: To identify and nurture research and innovation opportunities that are synergistic across rural industries.
   - **Priorities**: Informing debate on issues of importance to rural industries. Adapting new technologies for use across rural industries. Working collaboratively on issues common across rural industries.

3. **Growing Profitability**
   - **Goal**: Enhance the profitability and sustainability of our levied rural industries, Regional communities and the broader Australian economy depend on profitable farms.
   - **Priorities**: Engaging industry participants in determining RD&E priorities. Investing in innovations that assist levied industries to be more profitable. Delivering outcomes to maximise industry uptake and adoption.

4. **Emerging Industries**
   - **Goal**: Support new and emerging rural industries.
   - **Priorities**: Supporting the early stage establishment of high potential rural industries.

**Outcome**

- Rural industries are equipped with skilled people and the leadership to grow and prosper.

- Challenges and opportunities that are common across rural industries are identified and addressed.

- Industry participants are confident that their levy investment is delivering value.

- High-potential emerging rural industries established.

**Approach**

1. **1. Listening and influencing**
2. **2. Delivering results**
3. **3. Partnerships and collaborations**
4. **4. Performance culture**
5. **5. Efficient business practices**

**Values**

- Connected / Positive / Real / Future-thinking
- Innovative / Quality / Approachable / Networked / Confident
- Professional / Commercially savvy

**Purpose**

- Through research and development, increase knowledge and understanding that fosters innovation, adaptive and valuable rural industries.

**What is a Strategic RD&E Plan?**

The AgriFutures Honey Bee & Pollination Strategic RD&E Plan (2020-2025) has been developed by AgriFutures Australia, in consultation with honey bee and pollination stakeholders, to outline the AgriFutures Honey Bee & Pollination Program research, development and extension (RD&E) objectives until 2025.

The AgriFutures Honey Bee & Pollination Program Strategic RD&E Plan informs researchers and collaborators in the development of research proposals, and it guides AgriFutures Australia in investing Program funds. Delivery of the Strategic RD&E Plan is overseen by the AgriFutures Honey Bee & Pollination Advisory Panel, which is comprised of individuals who have on-ground industry knowledge and expertise, and technical or research experience. The Advisory Panel provides recommendations to AgriFutures Australia regarding projects and the organisations or individuals that can deliver on key strategies in the Strategic RD&E Plan, and it advises on how to encourage and promote the adoption of project findings.

There is a direct link between the AgriFutures Honey Bee & Pollination Program’s Strategic RD&E Plan and AgriFutures Australia’s Annual Operational Plan (AOP), which specifies key performance indicators (KPIs) for levied rural industries, including honey bee and pollination. The AgriFutures Honey Bee & Pollination Strategic RD&E Plan provides a Program-specific framework for meeting the KPIs in the AOP. The AgriFutures Australia Strategic R&D Plan 2017-2022 and AOP are available online at https://www.agrifutures.com.au/about/corporate-documents/.

The AgriFutures Honey Bee & Pollination Program aims to fund projects that reflect and respond to industry needs and concerns. Under this framework, Strategic Plan projects may be procured using open tender (open call), pre-qualified tender and limited tender methods. Open calls are managed through AgriFutures Australia’s project management system.

The typical annual open call cycle is:

- Open call announced for preliminary research proposals (PRPs).
- PRPs submitted by researchers and Advisory Panel meets to consider PRPs.
- Researchers notified of PRP outcomes; successful researchers invited to prepare a full research proposal (FRP).
- FRPs are submitted by researchers and the Advisory Panel meets to consider FRPs.
- Researchers notified of FRP outcomes; successful proposals proceed to contracting.
- Projects contracted, typically commencing in July of the following financial year.

Open calls may not run each year under this Strategic RD&E Plan. Use of the open call procurement method will depend on industry priorities and pre-existing RD&E expenditure commitments. An open call within the AgriFutures Honey Bee & Pollination Program was not conducted during 2018/19 due to conditions that affected program income (AgriFutures Australia, 2019a).
AgriFutures Honey Bee & Pollination Program

Industry profile 12
Financial commitments 14
Reserves policy 14
RD&E program management 14
Mid-term evaluation of the Honey Bee & Pollination Strategic Plan 15
Evaluation of the Plan 15
Communications plan 15
The AgriFutures Honey Bee & Pollination Program

Industry profile

The Australian honey bee industry produces between 20,000 and 20,000 tonnes of honey annually (AHBCG, 2019). Other honey bee products include paid pollination services, beeswax production, queen bee and packaged bee sales. Beekeepers’ financial receipts indicate that honey represents 85% of returns with pollination returning 11% (van Dijk et al, 2016).

There are approximately 25,053 registered beekeepers in Australia operating around 672,216 hives (AHBCG, 2019). Over 531,786 hives (79%) are operated by 1,781 (7.1%) commercial beekeepers with more than 50 hives and most commercial apiarists operate between 400-800 hives but some have more than 3,000 hives (AHBCG, 2019). NSW is home to 33% of Australian apiarists, Queensland 31%, Victoria 15%, Western Australia 10%, South Australia 8% and Tasmania 3%. An average of 44% of beekeepers undertook paid pollination services in 2014/15 up from 28% in 2005/06. 78% of large beekeepers were involved in paid pollination compared to 33% of small beekeepers (van Dijk et al, 2016).

The main honey production period is from October to March each year and August to October is the major pollination season. Approximately 70% of Australian honey is produced from native flora. This requirement for native flora highlights the dependence of Australian beekeeping on public and private land. In 2014/15 approximately 60% of Australian honey was sourced from private land with 40% coming from public lands (state forests, national parks and other public lands) (Van Dijk et al, 2016). About half the accessible apiary sites in native forests are on private land and half are on public land. Access to native flora on public land has declined over time. Beekeepers also regularly rely on access to native flora on public land to ensure hives are in good condition to provide pollination services to horticultural and agricultural industries.

Exports of Australian honey averaged 4,100 tonnes per year over the past five years. The top five export destinations for Australian honey in the 2018 financial year were Singapore, Malaysia, United Arab Emirates, China and Hong Kong. Imports of honey to Australia averaged 8,000 tonnes per year over the past three years (AHBCG, 2019). The Gross Value of Production (GVP) of honey was $129 Million in 2018/19 (AgriFutures Australia, 2019c) although the unrecognised value of pollination is believed to be in the order of $14.2 billion (Karasinski, 2019). The relatively small beekeeping industry GVP understates the industry’s value to agriculture and the economy in general through pollination services (which are essential for some crops, while for others it raises yield and quality) and potentially, the value of honey and honey products in medical uses.

The drought in Australia throughout the 2000s coincided with high international honey prices, resulting in substantial increases in wholesale prices in Australia. While international prices have subsequently declined, farm gate prices increased significantly in 2014 (AHBCG, 2019). While production has remained relatively static at around 20,000 tonnes per annum, prices received have risen substantially. In Western Australia prices for Jarrah honey have been edging up towards $30/kg from a base of $4/kg (QSOIBR 2018).

The beekeeping industry faces a number of risks, including the entry and spread of exotic pests and diseases, economic pressures on the honey producing industry, and reduced access by beekeepers to areas of native flora (Hafi et al, 2012). Australia is currently the only major beekeeping region/country left in the world that is free of the Varroa destructor mite. The impact of an exotic incursion is considered to be the most significant risk to the industry. Such an event would substantially increase beekeepers’ costs, reduce their productivity and limit the current extensive movement of hives around Australia. It is likely that in the event of a Varroa incursion Australia’s feral bee population will be largely eliminated (DAFF 2011), leading to the loss of much of the incidental honey bee pollination that many horticultural industries now rely upon.

There is a widely held view in the Australian scientific community that an incursion of the highly destructive Varroa mite is almost inevitable and that at some point the mite will become established. It is estimated that 20,000 crop industry businesses will be affected by the arrival of Varroa mite and the cost of the incursion is estimated to be in the order of $0.6 billion to $1.3 billion (depending on the port of incursion) over 30 years shared between beekeepers and crop losses (Hafi et al, 2012). Across Australia about 44% of beekeepers conducted paid pollination services in 2014-15 (van Dijk et al, 2016). Australian beekeepers who provided paid pollination services received an average of $44.200 from pollination in 2014-15. Paid pollinators in NSW and Victoria received significantly more on average than paid pollinators in other States (van Dijk et al, 2016). Cunningham (2014) estimated that more than 170,000 hives were being used annually in pollinating almond orchards at flowering. Queen bee breeding is specialised and there are growing markets, especially in North America, for Australian queen and package bees, although the USA has a current ban on the importation of live bees from Australia. While this sector of the industry is relatively profitable, the major constraints are: freight costs, the constant threat of export bans, and the limited number of skilled queen bee breeders (AgriFutures Australia, 2014).

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<td>88.4</td>
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<td>Tonnes</td>
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<td>4,641</td>
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<td></td>
<td>Beeswax</td>
<td>Tonnes</td>
<td>207</td>
<td>358</td>
<td>358</td>
<td>268</td>
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Table 1: Australian honey production, export and value, 2011-12 to 2015-16 (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee, 2018)
The AgriFutures Honey Bee & Pollination Program

Financial commitments

The AgriFutures Honey Bee & Pollination Program is supported by a statutory levy on honey sales in both domestic and export markets. Honey that is produced in Australia and sold, exported or used in the production of other goods will attract a levy and export charge. The total levy is struck at 4.6c/kg of honey sold but is only applied if more than 1,500kg of honey is produced in a calendar year. This levy was revised in July 2018 (DAWR, 2018b) and now is composed of:

- 2.7c/kg to AgriFutures Australia for honey bee and pollination research and development.
- 0.3c/kg to the Commonwealth for the National Residue Testing.
- 0.1c/kg for Plant Health Australia (PHA) membership and additional projects.
- 0.3c/kg to the Commonwealth for the National Residue Survey (NRS).
- 1.5c/kg to AgriFutures Australia for honey bee and pollination research and development.

The Australian Government matches expenditure from the Program, up to 0.5% of the GVP of the honey bee industry. Between 2014 and 2018 the Australian Government contributions to the AgriFutures Honey Bee & Pollination Program averaged approximately $405,000 per annum. AgriFutures Australia allocates its expenditure using a range of measures that ensure a balanced, financially responsible approach to its investment of both industry and core funds.

Reserves policy

The overriding aim of AgriFutures Australia is ‘to maximise the contribution of its RD&E investments to the profitability, sustainability and resilience of rural industries and communities’. In support of this objective, the holding of financial reserves is a supporting tool within the AgriFutures Australia Investment Framework to manage risk derived from fluctuations in income.

All AgriFutures Australia Programs have a reserves policy as agreed by the Program Advisory Panel to ensure the enduranc of the Program when faced with adversity such as a drop in production resulting the lower levy funding available to fund current research commitments.

The Program reserves policy is managed to approximately 50% of the RD&E budget. The underlying objective of holding financial reserves is to maximise the Program’s investment in RD&E, consistent with its business objectives, whilst enabling sufficient funds to be available to cover contracted liabilities and to maintain RD&E capacity. The reserves policy is intended as a guideline only, and is subject to change due to extreme circumstances, which may result in changes to the policy.

RD&E program management

The AgriFutures Honey Bee & Pollination Program is supported by the AgriFutures Honey Bee & Pollination Advisory Panel. The Advisory Panel is responsible for developing and ranking priority research proposals within the Strategic RD&E Plan’s framework and providing recommendations on the allocation of RD&E contributions to the AgriFutures Australia Board. The Advisory Panel has a particular role in ensuring its activities do not duplicate RD&E undertaken by other organisations. AgriFutures Australia has committed resources to the Program including a Manager, Research and a Coordinator, Research. The Manager, Research is formally a member of the Advisory Panel. Programs are apportioned corporate costs based on a three-year rolling average of expenditure including the current year forecast and the previous two years’ actual expenditure. This is then weighted and capped at 10% to ensure the variance in effort between small and large programs is captured as accurately as possible. The expenditure is reviewed on an annual basis, and any funding remaining is reinvested in Program RD&E.

Mid-term evaluation of the Honey Bee & Pollination Strategic RD&E Plan

The purpose of a mid-term evaluation is to ensure deliverables are being met and identify any change in scope that needs to be addressed. For the AgriFutures Honey Bee & Pollination Strategic RD&E Plan (2020–2025), the evaluation would begin at the commencement of year three.

Evaluation of the Plan

The evaluation of the AgriFutures Honey Bee & Pollination Program Strategic RD&E Plan (2020–2025) will include a cost-benefit analysis and will commence at the beginning of year five. The results will feed into the next Strategic Plan.

Communications plan

Details of contracted projects, program updates and the outcomes of projects are published on the AgriFutures Australia website and across a variety of AgriFutures Australia’s communications channels.

Stakeholder engagement is primarily through the AgriFutures Honey Bee & Pollination Advisory Panel, Quarterly Industry Updates (email newsletters), the Annual RD&E Snapshot and attendance at state and federal industry conferences. The Program will utilise communications expertise on an as-needs basis to develop communications resources to extend past and present RD&E of the program.

Strategic Plan (2020–2025) life cycle

All projects contracted throughout the Strategic Plan align with the AgriFutures Honey Bee & Pollination Program Objectives and within Budget.
The AgriFutures Honey Bee & Pollination Program


The AgriFutures Honey Bee & Pollination Five Year RD&E Plan (2014/15–2018/19) had an overarching aim to “Support RD&E that will secure a productive, sustainable and more profitable Australian beekeeping industry and secure pollination of Australia’s horticultural and agricultural crops.” The Program had five key objectives with a total of 30 strategies and 21 key performance indicators (KPIs):

1. Increase the profit and productivity of beekeepers (five strategies, one KPI, 12 projects).
2. Reduce the incidence and impact of pests and disease on the beekeeping and pollination services industry (seven strategies, seven KPIs, three projects).
3. Increase understanding of the role of flora in honey bee management (seven strategies, six KPIs, three projects).
4. Understand the role of pollination in delivering more productive systems (two strategies, one KPI, two projects).
5. Promote extension, communication and capacity building (nine strategies, five KPIs, 14 projects).


An independent economic review of the AgriFutures Honey Bee & Pollination Program Five Year Plan 2014–19 was undertaken by AgEconPlus (Clarke, 2019). The review aimed to understand the program successes, inform the development of the new Strategic RD&E Plan, and to meet Australian Government needs and evaluation requirements of the Council of Rural Research and Development Corporations (CRRDC).

The review involved an impact assessment of the AgriFutures Honey Bee & Pollination Program RD&E investment covering funded projects that were commenced during the five years between July 2014 to June 2019 (December 2018) and had produced substantial milestones by 31 December 2018. For the impact assessment a $200,000 total project investment threshold was applied, and these filters reduced the number of projects to 17. The projects were evaluated for potential impacts from each investment and described in a triple bottom line context.

The present value of benefits (PVB) and the present value of costs (PVC) were used to estimate investment criteria of net present values (NPV) and benefit-cost ratios (BCR) at a discount rate of 5%. The PVB and PVC are the sums of the discounted streams of benefits and costs. The internal rate of return (IRR) was estimated from the annual net cash flows. The modified internal rate of return (MIRR) was estimated using a re-investment rate of 5%. All costs and benefits were expressed in 2017–18 dollar terms (the most recently completed financial year) and discounted to 2017–18. Investment criteria were estimated for 0, 5, 10, 15, 20, 25 and 30 years from the year of last research investment for the Program. However, the 30-year benefit time frame was used in summary performance reporting and in all sensitivity analyses.

Costs for each project included the cash contributions of the Program (including both AgFutures and industry investment), as well as any other resources contributed by third parties (e.g., researchers, both as cash and in-kind). Program management costs were sourced and included in the analysis and any additional costs (e.g., commercialisation and extension) required to achieve uptake were considered. A counterfactual was developed that recognised previous investment and the possibility of investment occurring outside the Program and being supported by other funding parties (e.g., Australian Research Council and the CRC for innovation in the absence of AgriFutures support).

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions. Sensitivity analyses were undertaken for discount rate.

Two analyses were carried out at the AgriFutures Honey Bee & Pollination Program level. The first analysis referred to projects where significant impacts were identified and valued: In the first instance the PVB was compared to the specific investment in the projects (a total of five projects) generating the benefits. This process was likely to estimate an upper bound set of investment criteria for the Program investments as the analysis focussed on the highest impact projects.

The second Program level analysis refers to the same set of valued benefits from the five projects but compared them to the total investment in the Program population (17 projects). As there are likely to be some positive benefits from the projects where impacts were not valued, the results from this second analysis are likely to represent a lower bound set of investment criteria for the Program (Clarke, 2019).

Results and key findings

Total funding for the five projects where impacts were valued totalled approximately $2.83 million (present value terms) and produced aggregate total expected benefits of $11.68 million (present value terms). This gave an estimated NPV of $8.85 million, a BCR of 4.1 to 1, an IRR of 15.9% and a MIRR of 9.5%. The five projects valued totalled approximately $2.83 million (present value terms). This gave an estimated NPV of $8.85 million, a BCR of 4.1 to 1, an IRR of 15.9% and a MIRR of 9.5%. The five projects valued.

The present value of benefits from the five projects but compared them to the total investment in the Program population (17 projects). As there are likely to be some positive benefits from the projects where impacts were not valued, the results from this second analysis are likely to represent a lower bound set of investment criteria for the Program (Clarke, 2019).

The result from the cost-benefit analysis show that industry, the community and Government are expected to derive net benefits from investment in the AgriFutures Honey Bee & Pollination Program 1. July 2015 to 31 December 2018. The survey findings that revealed that the majority of beekeepers reported an increase in production of between 5% and 25% as a result of research for the five year period to 1 July 2015, which is consistent with the results from van Dijk et al. (2016).

ABARES has conducted three surveys of the honey bee and pollination industry: in 2014–15 (van Dijk et al, 2016), in 2008–07 (Crooks, 2008) and in 2000–01 (Rodriguez et al, 2003). This allows both point-in-time results to be reported as well as comparisons of trends over time.

The most recent survey was taken at approximately the same time as the commencement of the AgriFutures Honey Bee & Pollination Program Five Year RD&E Plan (2014/15–2018/19). The survey found that nationally, an estimated 74% of beekeeping businesses changed their management practices in 2014–15 as a result of research. Large beekeeping businesses changed their management practices to a greater extent than smaller operators. The majority of beekeepers felt that production had increased by between 5% and 25% over the five years to 2014–19 as a result of research. Western Australia reported the greatest increase in production, with 20% of beekeeping businesses reporting an increase of over 50% as a result of changing their management practices.
Honey Bee & Pollination Program Strategic RD&E Plan

2020-2025

AgriFutures Australia is committed to achieving significant benefits to industry within our available resources, through the implementation of targeted and high-impact RD&E projects.

The consultation process highlighted a number of issues that the Honey Bee & Pollination Program considers roadblocks to growth and development. Of these impediments, those that can be addressed with targeted RD&E have shaped AgriFutures Australia’s investment priorities for the next five years. Whilst not every problem raised can be addressed, these priorities aim to achieve high-impact, far-reaching benefits to the honey bee and pollination industries.

Preparation of the Strategic RD&E Plan

The AgriFutures Honey Bee & Pollination Strategic RD&E Plan (2020-2025) was developed in consultation with key stakeholders, industry representatives and members of the Honey Bee & Pollination Program Advisory Panel. Preparation of the Strategic RD&E Plan involved discussion of the current and future issues facing the industry and the role of RD&E in addressing these issues.

This included a workshop conducted in Melbourne on 21-22 February 2019 where Advisory Panel members and industry stakeholders outlined major opportunities, concerns and obstacles facing the honey bee and pollination industry, the types of RD&E that could assist in overcoming these issues and the key priorities going forward. A list of attendees is included in Appendix 2. The workshop allowed Advisory Panel members and industry stakeholders to identify constraints to sustainable industry growth as well as opportunities for increased development and types of RD&E that could assist and the key RD&E strategies to address these.

Industry consultation for the Strategic RD&E Plan

A draft was tabled to key industry stakeholders for their feedback in April 2020. The feedback was collated and tabled with the Honey Bee & Pollination Program Advisory Panel before being tabled to the AgriFutures Australia Board for approval.

Objectives and strategies

The comments and opinions received from the AgriFutures Honey Bee & Pollination Program Advisory Panel members and stakeholders have been consolidated into six key RD&E objectives and associated strategies, which have been outlined below in priority order.

The economic evaluation of the Honey Bee & Pollination Program Five Year RD&E Plan (2014/15-2018/19) (Clarke, 2019) identified five key projects that gave the greatest returns through the cost-benefit analysis. Whilst the key objectives have been refined in this plan, there is considerable overlap with the previous plan to ensure the most significant outcomes can be built upon in the new program. With this in mind, the objectives have been worded so they can be read as outcome areas, and their supporting strategies provide more specific direction, in line with RD&E priorities identified during the consultation phase with the industry stakeholders.

Allocation of funding for the RD&E priorities will be considered annually, as part of AgriFutures Australia’s Annual Operating Plan (AOP).
Objectives

1. Identify and develop technology for improved hive performance
2. Increase capacity within research community and future industry leaders
3. Improve understanding of nutrition best practice and disease interaction
4. Improve understanding of the benefits of honey and develop chain traceability
5. Improve understanding of pollination strategies that impact crop yields and improve hive health
6. Improve understanding of floral resources as assets for the Australian honey bee industry
**Identify and develop technology for improved hive performance**

1. **Objective**

   **Goal**
   
   This objective aims to identify and develop technologies that can increase productivity and profitability of beekeepers by developing strategies to reduce labour and improve early detection of pests and diseases. Approaches will include strategies to improve yield and disease resistance, technology advances to enable early detection of diseases, and developing strategies to manage and protect valuable equipment located at remote sites.

   **Strategies**
   
   1.1. To support developments in the use of sensing technology (electronic nose) to detect specific odours related to hive health (queen status/diseases).
   1.2. To develop the industry’s ability to protect and remotely manage high value equipment and hives on remote bee sites.
   1.3. To adopt technology to generate greater efficiencies within beekeeping.

   **KPIs**
   
   • Greater profit through early detection of hive health and disease, hive production and protection of expensive assets in remote areas.
   • Increase adoption of, and cross-industry utilisation of, technologies.

   **Impacts and consequences**
   
   • There will be a greater need to remotely manage and protect remote hive sites if the industry is successful in increasing the value of honey. Hives are often not monitored remotely at present and this leaves them open to theft, pests and diseases. An increase in value of bioactive honeys will result in an increase in worth of hives, which will mean a great need to monitor and understand these resources.
   • The lack of technology development and uptake by the honey bee and pollination industry is a concern. Certain apiarists are known to have low uptake of technology but the next generation of apiarists are looking to technology to solve issues and problems within the industry. However, a lack of uptake could see technologies fail. Decreasing the cost of these technologies is also an important consideration, as is improving beekeeper ownership and affordability of data storage. To mitigate this risk it is imperative that the technology is of need and of benefit to the industry.
   • Ability for beekeepers to remotely and unobtrusively measure hive performance could be an important impact of this objective. Hive performance not only includes production of honey or pollination services but also includes management of pests and diseases, and other challenges.

   **Indicative share of RD&E Budget:**
   
   26%

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**Increase capacity within research community and future industry leaders**

2. **Objective**

   **Goal**
   
   This objective aims to undertake capacity building through professional development of key researchers and future industry leaders and to promote research outcomes to beekeepers in their preferred format. The industry also needs readily available key statistics to demonstrate value to both industry and Government participants.

   The program has completed a great deal of research that is still very relevant, and this objective is focused on understanding by what methods and how this research could be communicated to beekeepers. Development of industry statistics and industry understanding will help drive this objective. The Program will also look into industry support through professional development of key researchers and future industry leaders.

   **Strategies**
   
   2.1. To understand and use different extension platforms more effectively for providing research outcomes to beekeepers.
   2.2. To collate available industry statistics and develop a pathway to ensure that regular, accurate statistics are available for Government and industry.
   2.3. To ensure capacity is maintained via support for young scientists and emerging industry leaders through targeted activities including structured courses, scholarships and study tours.
   2.4. To utilise past and present research outcomes to develop tools that can be understood by all beekeepers.

   **KPIs**
   
   • Annual RD&E report published by AgriFutures Australia.
   • Support for industry development of communications and public relations (e.g. state and national newsletter, extensionAUS for professional beekeepers).
   • Commence a bi-annual bursary for the support of industry and research.
   • Provide support for industry leaders and early career researchers.
   • Development of standardised statistical data methodology for reporting on the honey bee and pollination industry.
   • Provide current past and present research to beekeepers in a suitable format.

   **Impacts and consequences**
   
   • The honey bee and pollination industry will have strong leadership with a pool of prospective leaders and researchers being developed and supported.
   • The industry will have ready access to relevant statistics for industry and Government.
   • A range of extension tools have been developed to help beekeepers adapt to change, increase profitability and maintain viable businesses.

   **Indicative share of RD&E Budget:**
   
   22%
**Improve understanding of nutrition best practice and disease interaction**

**Objective**

3. **Goal**

This objective aims to reduce the incidence and impact of pests and diseases to the beekeeping and pollination industry through a better understanding of the relationships between nutrition and disease. It also aims to ensure that contingency plans are in place in the event of exotic incursions.

**Strategies**

3.1. Improved understanding of the impact and interactions of pests, diseases (endemic and exotic) and nutrition on bee health.

3.2. Improving the understanding of honey bee nutrition.

3.3. Better understanding of how supplementary feeding can generate different desired outcomes.

3.4. Develop strategies for supplementary feeding that avoid honey contamination issues.

**KPIs**

- Reduced measurable impacts of current and exotic pests and diseases leading to improved profitability.
- Reduced measurable impact of key diseases through early identification and improved control measures.
- Improved bee health through use of pre- and pro-biotics and improved nutrition.
- Understand and develop best practice for supplementary feeding to decrease issues associated with honey contamination.

**Impacts and consequences**

- There will be more resilient hives that can cope with pest and disease threats.
- The industry will understand the implications of supplementary feeding in relation to pollination and honey contamination.
- The industry will have a better understanding of interaction between nutrition and disease on bee health.

**Indicative share of RD&E Budget:**

18%

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**Improve understanding of the benefits of honey and develop chain traceability**

**Objective**

4. **Goal**

This objective aims to accurately determine provenance and identify adulteration in honey to ensure Australian beekeepers benefit from the advantages of Australian honeys. If the presence of bioactive compounds in honey can increase its value substantially, it follows that there will be increased need to demonstrate provenance and through chain traceability. Biological activity in honey includes non-peroxide dependant antibacterial activity, peroxide dependant antibacterial activity, antifungal properties or prebiotic activity that stimulates growth of gut microbes.

**Strategies**

4.1. To investigate the different bioactivities of honeys to support various claims.

4.2. To conduct research to understand and investigate consumer trends for honey sales and its implications for levy payers.

4.3. Research into a range of identification techniques to ensure integrity, provenance and quality of honey at least cost.

**KPIs**

- Higher returns to beekeepers for specific Australian honeys with demonstrated bioactive properties.
- Greater use of bioactive honeys to reduce the impacts of antibiotic resistant infections.
- Development of alternate and new markets for specific Australia honeys.
- Facilitate the understanding of available technologies to identify honey adulteration and provide further support where necessary.

**Impacts and consequences**

- Being able to accurately determine provenance and identify adulteration will enable protection of markets and support the reputation of Australian honey as clean and green.
- Alternate and new markets will be developed for honey producers to access

**Indicative share of RD&E Budget:**

15%
Improve understanding of pollination strategies that impact crop yields and improve hive health

**Objective**

This objective aims to develop a greater understanding of hive health when providing pollination services. This includes increasing understanding about issues such as hive density (especially under netting or protected cropping), placement of hives, companion plantings to improve bee nutrition, supplementary feeding of bees, and pesticides and hive health.

**KPIs**

- Improved knowledge base of the effects of commonly used chemicals in pollination dependent crops.
- Projects that investigate the impacts of protected cropping on honey bee pollination services.
- New established crop specific guidelines for the use of supplementary feeding when on pollination.
- Increased understanding of the viability of companion planting in a range of crop types and the effects this can have on hive health during pollination.

**Impacts and consequences**

- Improved hive health outcomes for honey bees when on pollination.
- More willingness of apiarists to offer pollination services as a result of improved hive health.
- Increased adoption of companion planting techniques that will improve the health of all pollinators including honey bees.
- Better outcomes for both the farmer and the beekeeper.

**Indicative share of RD&E Budget:**

- 10%

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Improve understanding of floral resources as assets for the Australian honey bee industry

**Objective**

This objective aims to provide a scientific and objective rationale to the improved access to public lands for the beekeeping industry. Understand the barriers, at both the land management and policy levels, and provide research and development outcomes that can encourage access.

**KPIs**

- Industry has a greater pool of available research on the effects of honey bees on public lands to underpin sound policy decisions.
- Access to floral resources is maintained on public and privately-owned land. Options to improve resources are actively pursued and beekeepers have community recognition as providing a public good.
- Clear strategies on floral resource management and use by beekeepers are developed to guide both industry and AgriFutures Australia into the future.

**Impacts and consequences**

- Improved and maintained access to public lands for honey bees.
- Greater involvement with land management groups, forestry and horticulture to ensure a diversity of floral resources on public and private lands.

**Indicative share of RD&E Budget:**

- 9%
### AgriFutures Honey Bee & Pollination Program Strategic RD&E Plan (2020-2025)

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Impacts &amp; consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective one:</strong> Identify and develop technology for improved hive performance.</td>
<td></td>
</tr>
<tr>
<td>1.1 To support developments in the use of sensing technology.</td>
<td>To solve a critical problem or support a change, increase profitability and develop new markets.</td>
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<tr>
<td>1.2 To develop the industry’s ability to protect and remotely manage high value equipment and hives on remote bee sites.</td>
<td></td>
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<tr>
<td>1.3 To adopt technology to generate greater efficiencies within beekeeping.</td>
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<tr>
<td>• Remotely manage and protect remote hive sites if the industry is successful in increasing the value of bioactive honeys.</td>
<td>26%</td>
</tr>
<tr>
<td>• The lack of technology development and uptake by the honey bee and pollination industry is a concern. To mitigate this risk it is imperative that the technology is of need and of benefit to the industry.</td>
<td></td>
</tr>
<tr>
<td>• Ability for beekeepers to remotely and unobtrusively measure hive performance but include management of pests and diseases, and other challenges.</td>
<td></td>
</tr>
<tr>
<td><strong>Objective two:</strong> Increase capacity within research community and future industry leaders.</td>
<td></td>
</tr>
<tr>
<td>2.1 To understand and use different extension platforms more effectively for providing research outcomes to beekeepers.</td>
<td>22%</td>
</tr>
<tr>
<td>2.2 To collate available industry statistics and develop a pathway to ensure that regular, accurate statistics are used.</td>
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<tr>
<td>2.3 To ensure capacity is maintained via support for young scientists and emerging industry leaders.</td>
<td></td>
</tr>
<tr>
<td>2.4 To utilise past and present research outcomes to develop tools that can be understood by all beekeepers.</td>
<td></td>
</tr>
<tr>
<td>• The honey bee and pollination industry will have strong leadership with a pool of prospective leaders and researchers being developed and supported.</td>
<td></td>
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<tr>
<td>• The industry will have ready access to relevant statistics for industry and Government.</td>
<td></td>
</tr>
<tr>
<td>• A range of extension tools have been developed to help bee keepers adapt to changing market forces and maintain viable businesses.</td>
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</tr>
<tr>
<td><strong>Objective three:</strong> Improve understanding of nutrition, best practice and disease interaction.</td>
<td></td>
</tr>
<tr>
<td>3.1 Improved understanding of the impact and interactions of pests, diseases (endemic and exotic) and nutrition on bee health.</td>
<td>18%</td>
</tr>
<tr>
<td>3.2 Improving the understanding of honey bee nutrition.</td>
<td></td>
</tr>
<tr>
<td>3.3 Better understanding of supplementary feeding.</td>
<td></td>
</tr>
<tr>
<td>3.4 Develop strategies for supplementary feeding that avoid honey contamination issues.</td>
<td></td>
</tr>
<tr>
<td>• There will be more resilient hives that can cope with pest and disease threats.</td>
<td></td>
</tr>
<tr>
<td>• The industry will understand the implications of supplementary feeding in relation to pollination and honey contamination.</td>
<td></td>
</tr>
<tr>
<td>• The industry will have a better understanding of interaction between nutrition and disease.</td>
<td></td>
</tr>
<tr>
<td><strong>Objective four:</strong> Improve understanding of the benefits of honey and develop chain traceability.</td>
<td></td>
</tr>
<tr>
<td>4.1 To investigate the different bioactivities of honeys to support various claims.</td>
<td>15%</td>
</tr>
<tr>
<td>4.2 To conduct research to understand and investigate consumer trends for honey sales and its implications for levy payers.</td>
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<tr>
<td>4.3 Research into a range of identification techniques to ensure integrity, provenance and quality of honey at least cost.</td>
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<tr>
<td><strong>Objective five:</strong> Improve understanding of pollination strategies that impact crop yields and improve hive health.</td>
<td></td>
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<tr>
<td>5.1 To investigate pollination strategies that impact on crop yields and reduce stressors on hive health.</td>
<td>10%</td>
</tr>
<tr>
<td>5.2 Create greater understanding of the hive densities required and the influences of protected cropping systems.</td>
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<tr>
<td>5.3 Investigate the effects of commonly used chemicals, when used in pollination services.</td>
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<tr>
<td>5.4 Evaluate methods of improving hive health when pollinating crops.</td>
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<tr>
<td><strong>Objective six:</strong> Improve understanding of floral resources as assets for the Australian honey bee industry.</td>
<td></td>
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<tr>
<td>6.1 Improve understanding of the impacts managed honey bees may have on native flora and fauna.</td>
<td>9%</td>
</tr>
<tr>
<td>6.2 Provide science based evidence to promote access to public lands for honey bees.</td>
<td></td>
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<tr>
<td>6.3 Promote industry relationships with land management groups, forestry and horticulture to retain and expand access to resources and public lands (social license).</td>
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</tr>
<tr>
<td><strong>Overarching principles</strong></td>
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<tr>
<td>• All projects should specify clear outcomes or KPIs and include clear extension and adoption components.</td>
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</tr>
<tr>
<td>• Projects should seek to address industry-specific RD&amp;E areas where market failure exists.</td>
<td></td>
</tr>
<tr>
<td>• Objectives are highly interlinked and, when appropriate, projects should indicate and apportion their inputs/outcomes across all relevant objectives.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix

Industry consultation – workshop Attendees

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annelies McGaw</td>
<td>AgriFutures Australia Manager, Research</td>
</tr>
<tr>
<td>Annie Lane</td>
<td>AgriFutures Australia Coordinator, Research</td>
</tr>
<tr>
<td>Michael Clarke</td>
<td>Principal AgEconPlus - reviewed the 2014/15-2018/19 RD&amp;E Plan</td>
</tr>
<tr>
<td>Murray Spicer</td>
<td>AgriFutures contractor - writing the new Strategic RD&amp;E Plan (2020-2025)</td>
</tr>
<tr>
<td>Sarah Paradice</td>
<td>AHBIC CEO</td>
</tr>
<tr>
<td>Peter McDonald</td>
<td>AHBIC Chairman</td>
</tr>
<tr>
<td>Doug Somerville</td>
<td>HBPAP Chair, Technical Specialist (apairy) Department of Primary Industries, NSW</td>
</tr>
<tr>
<td>Danny Le Feuvre</td>
<td>HBPAP member, Managing Director Australian Bee Services (pollination and honey)</td>
</tr>
<tr>
<td>Sam Malfroy</td>
<td>HBPAP member, Senior Project Officer at Department of Premier and Cabinet (NSW Government)</td>
</tr>
<tr>
<td>Diana Leemon</td>
<td>HBPAP member, QLD Department of Agriculture and Fisheries</td>
</tr>
<tr>
<td>Ashley Zamek</td>
<td>HBPAP member, R&amp;D Manager, Hort Innovation</td>
</tr>
<tr>
<td>James Kershaw</td>
<td>HBPAP member, Fifth Generation Bee Keeper, Sterling Kershaw &amp;Co (honey)</td>
</tr>
<tr>
<td>Tiffane Bates</td>
<td>HBPAP member, Apiary Manager at the Centre for Integrative Bee Research, UWA, Researcher at CRCHBIP</td>
</tr>
<tr>
<td>Saul Cunningham</td>
<td>HBPAP member, Professor at the Fenner School, ANU</td>
</tr>
</tbody>
</table>

A workshop was conducted in Melbourne on 21 and 22 February 2019 where industry stakeholders outlined major concerns, obstacles and opportunities facing the honey bee and pollination industry, the types of RD&E that could assist in overcoming these issues and the key priorities going forward.

Pollination services

Across Australia, an estimated 44% of beekeepers conducted paid pollination services in 2014–15. The proportion was highest in South Australia and Tasmania, states that produce high levels of almonds, cherries, apples, pears and other crops dependent on bee pollination.

Australian beekeepers who provided paid pollination services received an average of $44,200 from pollination in 2014–15. Paid pollinators in NSW and VIC received significantly more on average than paid pollinators in the other states.

An estimated 43% of beekeepers across Australia who provided paid pollination services in 2014–15 planned to expand this aspect of their business over the next five years and 32% stated that they would remain the same. Among those beekeepers who did not provide paid pollination in 2014–15, around 8% indicated they were likely to commence paid services over the next five years.
### Industry issues and opportunities

#### Public land access and use

Nationally, an estimated 39% of honey production was derived from public land in 2014-15. Tasmania derived the greatest proportion of honey production from public land (92%) and South Australia derived the lowest (7%). Generally, those beekeeping businesses that operated a greater number of hives used public land for honey production to a greater extent than operators with fewer hives. Nationally, around 32% of beekeeping businesses decreased their usage of public land over the five years to 2014-15, 21% increased usage and 47% remained the same. The main reasons reported for decreasing use of public land for honey production included restricted site access as a result of Government policy or regulatory challenges and extreme weather events (such as bushfires).

#### Industry challenges

The beekeeping industry faces a number of challenges through issues affecting the floral resource base which in turn can impact the volume and quality of production. Drought was the most commonly reported challenge – with 70% of beekeepers indicating that drought had affected their floral resource base over the five years to 2014-15. Around 50% of beekeepers indicated that use of agricultural chemicals such as pesticides, fungicides and herbicides also impacted floral resources. Another challenge for the beekeeping industry is the presence of pests and diseases. Over the five years to 2014-15, small hive beetle and the fungal disease chalkbrood were the two most common pests and diseases identified by beekeepers. Over 50% of beekeepers also indicated that wax moth and American foulbrood (AFB) had some impact on their honey and related production over the five years to 2014 to 15 (van Dijk et al, 2016).

#### Cooperative Research Centre for Honey Bee Products (CRCHBP)

The five-year CRCHBP was established in 2017 based at the University of Western Australia with support from the University of Tasmania and a number of Government and industry partners. AgriFutures is a foundation partner in the CRCHBP. The CRCHBP has identified a number of key industry issues and has proposed four key research areas for the forthcoming five-year research program.

Hive site - The hive site program will help protect existing sites, inform bee hive movement and rehabilitate land into new high-value hive sites. Australian Manuka honey will be a new product.

Bee health - To contribute to honey bee health, the CRCHBP will work towards future-proofing the bee industry and developing a catalogue of disease markers.

Honey products - The honey bee product program will add value to the industry through developing honeys from known floral sources for the export market.

Chain of custody - This program will use all the information from the CRCHBP to develop a chain of custody. This will be linked to developing and testing product quality labels in the export market. Further information can be obtained at www.crchoneybeeproducts.com/research-programs/

As would be expected there is considerable overlap between the Program Objectives of the CRCHBP and those identified at the industry workshop for the AgriFutures Honey Bee & Pollination Program Strategic RD&E Plan (2020-2025). It is expected that AgriFutures Australia will be able to maximize outcomes for industry by strategically funding gaps identified in the CRCHBP program and bring additional expertise into the programs where relevant.

#### Biosecurity

In January 2012 the management of the National Bee Biosecurity Program was transferred from Animal Health Australia to Plant Health Australia. In 2013 the CSIRO released a risk assessment of ports for bee pests and pest bees, which estimated the relative likelihood of establishment of pest bees and/or bee pests at Australian ports. Both of these activities were supported by AgriFutures Australia projects. This allowed for review and redesign of the surveillance program in 2016 with support from Hort Innovation. The development and roll out of the National Bee Pest Surveillance Program (Plant Health Australia, 2019) was further underpinned by a number of AgriFutures Australia projects (AgriFutures Australia, 2019b).

It was timely that the 2014-19 key strategies addressed many of the industry challenges outlined in the ABARES survey reported in 2016 (van Dijk et al. 2016). The economic analysis by Clarke (2019) clearly demonstrated a positive benefit/cost ratio for the research conducted in this program.
References


