Australian Pork Limited

AUSTRALIAN Pork®

Innovation Plan 2020-25

ABOUT THIS DOCUMENT

The Australian Pork Limited (APL) Board has approved an ambitious new strategy. It requires internal change and broader external collaboration and contact.

The internal change requires the various skill sets inside APL to be leveraged as appropriate across all strategic themes and programs across APL.

This is a significant change as it means a broader group of people involved in a broader array of activities than just the Research and Innovation (R&I) team within APL.

Therefore this document is a "conversion" step, outlining how the Innovation program supports the whole APL strategy. The document also outlines where input from other APL sub-teams will be critical.

This document explains the background to the changes in innovation at APL; how the innovation process and the research program will be managed; and the initial innovation programs set for 2020-2025 delivery.

EXECUTIVE SUMMARY

APL embarked on a new Innovation Plan following an external review of Innovation and the R&D Model for industry investment into APL and APRIL, conducted in 2018.

At the same time, the Federal Government also reviewed the Rural Research & Development Corporations (RDCs) funded by the Department of Agriculture and Water (DAWE) under the Council of RDCs', published as a report on Agricultural Innovation in 2019.

This paper describes how APL will drive research and innovation into the pig industry to provide impactful outcomes. This innovation will address challenges and opportunities along the pork supply chain, in line with APL's 2020-2025 Strategic Plan.

This paper provides a background to the purpose of Innovation for the pork industry and why there is a need for a new approach. It considers the recommendations of the Government's review of RDCs, as well as the external review of the R&D process within APL.

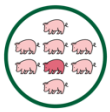
A brief description on the scope and approach APL has taken to manage the innovation process is provided. This includes new terminology used by APL and an outline of the procedures for proposal submission and proposal review.

Finally, this document outlines the Innovation Plan in terms of the portfolios of R&I responsibility. It also covers those identified by the APL Board as Strategic Intents for prioritised transformational investment for the pork industry.

Within these portfolios and Strategic Intents, the five-year strategic direction to innovation is outlined, with proposed research projects described for the Annual Operating Plan (AOP) 2021/22.

The overall aim of APL's Innovation Plan is to provide technical and innovative solutions for industry as part of all themes of the 2020-25 Strategic Plan (see below). Strategic Intents currently identified by the APL Board are highlighted in bold.

Strategic Themes

 Market and Product Differentiation	 Manage Volatility for Viable Farms	 Drive Consumer Demand	 Leading Community Social Licence	 Building Industry Shared Vision
• Processing, 21C rendering • **Eating quality** • AMS and Welfare	• Processing, 21C rendering • **Reduce cost of production** • AMS and Welfare	• Traceability and integrity • **Eating quality**	• **Biosecurity leadership** • **Climate friendly farming** • AMS and Welfare	• Traceability and integrity • **Reducing cost of production** • AMS and Welfare • Capacity and Capability

THE PURPOSE OF INNOVATION TO APL - Background

It is impossible for APL to achieve our purpose "*to enable a thriving pork industry*" without innovation. The world evolves and if we are to be a progressive organisation, we need to evolve faster than our operating environment does. We define innovation as:

"To create valuable solutions to important problems or new opportunities that are adoptable and cost-effective, so that embracing innovation is rewarding to all producers and benefits the supply chain and stakeholders."

In 2018, DAWE commissioned EY to develop a shared vision to position the Australian agricultural innovation system for the future.

Their final report on Agricultural Innovation - *A National Approach to Grow Australia's Future* was published in 2019. The report identified that for agricultural innovation to work effectively in the future, there will need to be fundamental change by agriculture industry bodies.

Of specific highlight was the need for agile investment and funding opportunities; flexibility; wider collaboration beyond the scientists with known industry background and knowledge; and a cultural change to research funding processes.

There were five recommendations from the report that guide and determine Commonwealth investment into APL and all RDC's into the future. These are:

1. Strengthening leadership for strategic direction, but also for improving connections, collaboration, and culture.
2. Balancing funding and investment to solve short-term challenges as well as targeting transformational and cross-commodity outcomes.
3. Establishing world-class innovation practices including disruptive thinking, ambition and entrepreneurship to maximise opportunities from our investments.
4. Strengthening the regions to maximise innovation uptake and provide regions with a greater role in national priority-setting.
5. Establishing the next generation innovation platform for our data, physical infrastructure, and regulatory environment.

There is an emphasis on transformational innovation; an innovation culture that is more dynamic, entrepreneurial, and more collaborative. It focussed on culture that is ambitious and prepared to take on more risk. The report suggested industries need to engage with non-traditional innovative sectors and scientific participants to expand capacity and capability, as well asand widen opportunities for co-investment from public and private sectors.

Anew innovation approach for APL is required, embracing a balance of incremental and disruptive innovations. It is with these themes in mind that APL is embarking on its Innovation Plan for the future delivery of outcomes for the pork industry with the continued support of the Commonwealth government. SCOPE AND APPROACH TO WORKInnovation applies to all of APL, including market

and product differentiation; managing volatility for viable farms; driving consumer demand; leading community social licence; and building an industry-wide shared vision.

This document highlights the investment that goes to Research and Innovation projects. It should be noted that this is only part of the allowable R&D funds that are sourced from the $1 levy + matching $1 funds from the Rural RDC Commonwealth funding program.

These R&D funds are also spent in Marketing, Policy, ICT, Producer Relations and Communications for projects meeting the matching claim criteria. There are also programs funded in the R&I research program from grants (under Grant income in budgets). APL acknowledges that non-R&D funds will play a part in some investment decisions.

Solutions and Horizons

APL's innovation program targets an allocation of investment to either Horizon or Solutions projects. The strategy is to allocate a lesser portion of total research funds into Solutions projects (currently targeted as 30%). This means the majority of funds are available for Horizon projects - transformative and long-lasting industry investment.

Historically, APL has funded research projects that are business as usual research experiments. It has funded extension and demonstration activities as well as impact measurements of the delivery of relatively immediate outcomes.

Solutions projects may be either pro-active or responsive and typically the risk of not achieving project outcomes is low. Adoption from Solutions projects can be limited by specific farm factors such as production type, genetics, or specific farm environmental factors, including disease presence and successful design implementation.

Solutions projects fill knowledge gaps as missing pieces of data or understanding. This information can then be used to improve the current way of doing things in the industry to make it easier or more rewarding. Solutions projects can also be a prelude to larger Horizon projects.

The majority of innovation investment is to be dedicated to Horizons projects. These are more transformative in scope and target outcomes, and if successful could change the way things are done within the industry.

They also represent a higher degree of risk, requiring several projects running in parallel, and can involve different collaborating participants to deliver an acceptable chance of success. Horizons projects are aimed at the delivery of significant value to the industry, with the outcome of increasing industry net value.

Innovative Process

APL supports impactful, targeted research activity which is ambitious in its focus on transformative commercial solutions for the future. The programencourages ongoing producer interest and engagement.

The framework also works to ensure research projects are a dynamic component of a whole-of-APL approach to building a thriving Australian pork industry. Further detail on the Innovation planning process is provided in Appendix I.

Practically what this means is once a Strategic Intent is defined – i.e. decreasing non-grain cost of production by 15% by 2025, then ideas are sourced using a wide variety of techniques such as:

- The current Australian pig research network.
- Workshops with producers and/or experts in related fields or experts in leverageable technologies.
- Interviews with domestic and international experts.
- Networks in academia both in Australian and overseas.
- Networking in commercial organisations solving similar problems.

Networking with venture capitalists and entrepreneurial hubs both domestically and overseas. APL will outsource certain skillsets to facilitate the Innovation Planning Process. This will expedite the commencement of research projects within the Horizon programs.

These skillsets currently identified are the facilitation of design ded ideation; qualitative research into concept evaluation; and innovation investment business case development. This allows APL R&I staff to focus on the project management of the research program. It also allows them to contribute to identifying the needs and opportunities from industry and source potential ideas or groups of people that can form new networks.

The APL Innovation Planning process considers more than research project management. In the past, Specialised Groups (SGs) were set up to provide the identification of industry priorities within Market Development; Production and Welfare; Environmental Management; and Biosecurity and Product Integrity.

Although SGs have been discontinued as a result of the APL Review into R&D, the industry input is still provided through participation into ideation workshops, concept reviews and where possible research proposal reviews. Producer engagement is crucial for increasing awareness of the innovation planning process required, and to provide insight as to potential industry extension for adoption.

<u>Proposal Submission Process</u>

Research project investment will be through a combination of strategic Horizon Programs and APL Solutions projects. The process of project submission has changed to increase flexibility.

At any time, possible Solutions projects are identified by Reference Working Groups who represent industry and technical expertise (e.g. ASF Industry Technical Panel; Eating Quality Technical Reference Group; Australian Pig Vetsand/or APL Research Program Managers).

Unless a specific group is identified to submit a proposal, an invitation is issued for a *Request for Proposal.* The Principle Investigator (PI) is asked to discuss the proposal with the relevant APL Research Program director and the Genera Managere of R&I.

If an idea has scientific merit, has not been done before and meets industry outcome priorities the PI is encouraged to collaborate with others in the industry and importantly outside of the industry with appropriate technical knowledge.

The PI will then prepare a project submission in APL's customer relationship management (CRM) database. Budgets will be initially defined by AOP portfolio allocations (f refer to Appendix I).

From the Strategic Plan 2020-25, the APL Board has so far selected the Horizons highlighted in purple below. APL recommends the intent represented in pink is added as the next Strategic Intent to invest in.

For each portfolio there is a measurable goal set (in the Strategic Plan Key Results Areas). In these cases, they are:

1. Quality eating experiences – increase average purchase fresh pork volume to 11 kg per head per annum by June 2025.
2. Reduce cost of production (relative to June 2020 grain price of) by 15% by June 2025.
3. Create 2 biosecurity leadership positions by June 2025. (e.g. all APIQ registered producers to have an auditable biosecurity plan by June 30, 2022; AUSVETPLAN and all AHA policies relating to pig production to be reviewed and amended by June 30 2022).
4. Create 2 climate friendly farming leadership positions by June 2025 (e.g. Lower GHG emissions through biogas adoption; zero waste going into landfill.)

Figure 1. The identified Strategic Intents chosen by the APL Board and additional APL recommendation for research funding.

These Strategic Intents are selected based on their capacity to deliver benefits to Australian pork producers. It is recognised progress in a particular portfolio may well deliver additional benefits over and above the base purpose of the Horizon. An example is outlined below.

Strategic Intent option -	Improves end consumer value	Attracts talent to industry	Improves pigs lives	Builds climate friendly credibility	Adds to producers earnings	Return on assets accreditive	Diversifies products & Markets	Adds business options to producers	Adds to industry knowledge & data	Prevents rather than responds
Quality consumer eating experiences	✓✓✓	✓			✓✓	✓	✓✓	✓	✓	✓
Reduced cost of prod. & process	✓✓	✓	✓	✓	✓	✓	✓✓	✓✓	✓	✓
Biosecurity Leadership	✓	✓	✓✓	✓	✓	✓	✓✓	✓	✓✓	✓
Climate Friendly Farming	✓✓	✓✓	✓	✓✓✓	✓✓✓	✓	✓	✓	✓✓	✓

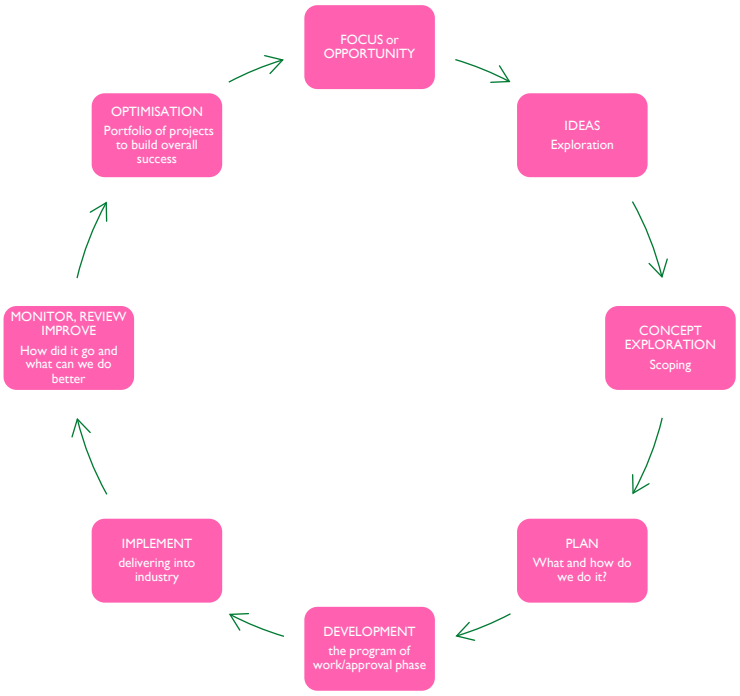
Figure 2. Horizon investment relative benefit evaluation

THE PORTFOLIO OF STRATEGIC INTENTS

The first three priorities set by the Board in 2020 were Cost of Production and Processing (COPP), Eating Quality and Biosecurity. There are several strategic actions identified to fall within each broad area of strategic intent.

These have been captured in diagrammatic break-down into sub-strategies (Figure 3). Not all possible areas of research can be invested in given limited financial and human resources within APL. Sub-strategies in light shading in Figure 3a are identified as having lower priority in the FY2021/21 but could be invested into in future years.

It is important to highlight that the APL Innovation Plan is dynamic, evolving each year in sub-strategies and possible innovation projects. The process of innovation is circular - new ideas and concepts are evaluated, research projects developed and tested, outcomes are commercialised and adopted. The innovation is then measured, reviewed and improved. At each process endpoint, new information is learned and can spin off into new ideas, concepts, research project and so on.


FOCUS or OPPORTUNITY
IDEAS
Exploration
CONCEPT EXPLORATION
Scoping
PLAN
What and how do we do it?
DEVELOPMENT
the program of work/approval phase
IMPLEMENT
delivering into industry
MONITOR, REVIEW IMPROVE
How did it go and what can we do better
OPTIMISATION
Portfolio of projects to build overall success

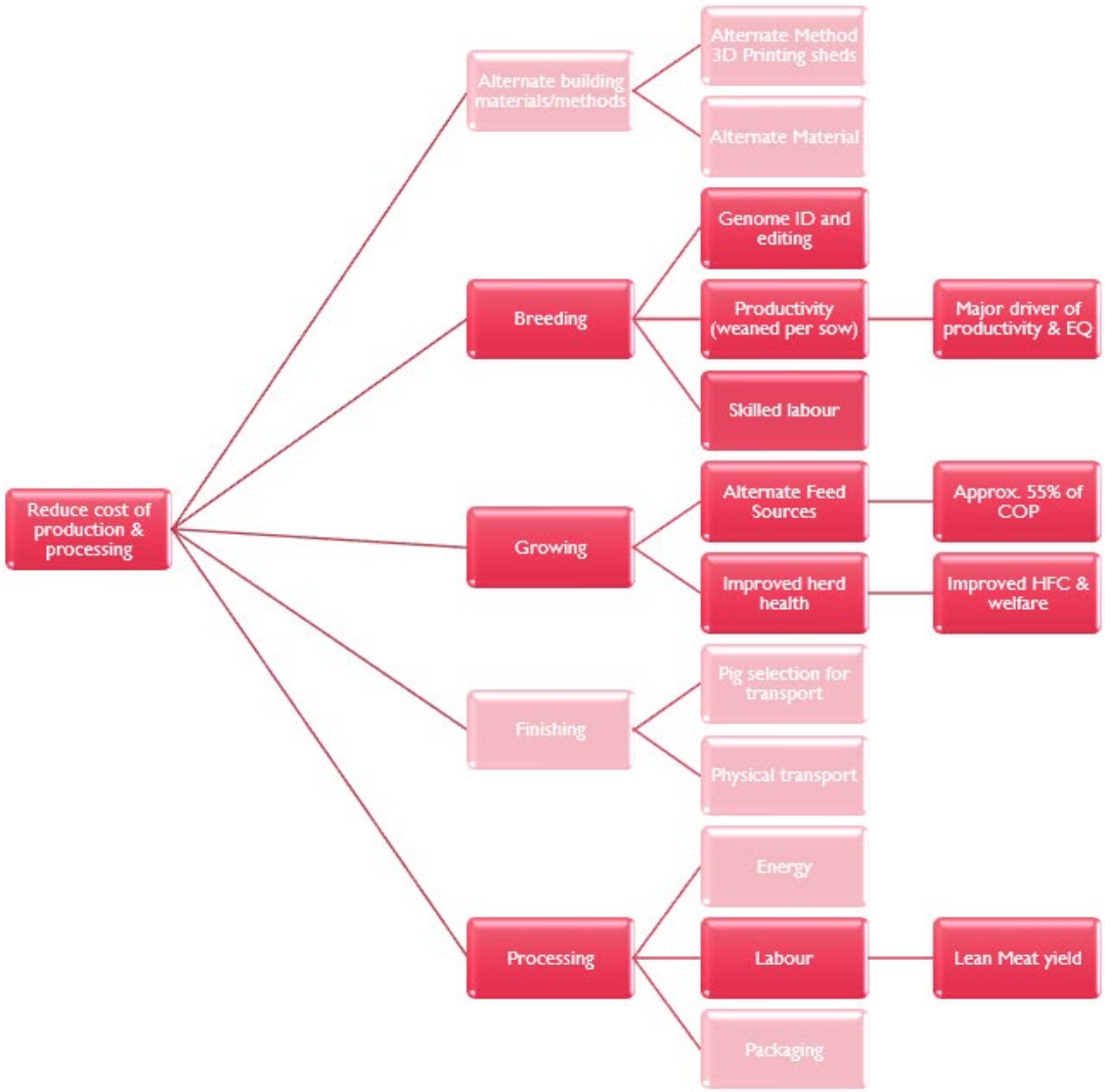


Figure 3a. Sub-strategies – COP&P Portfolio

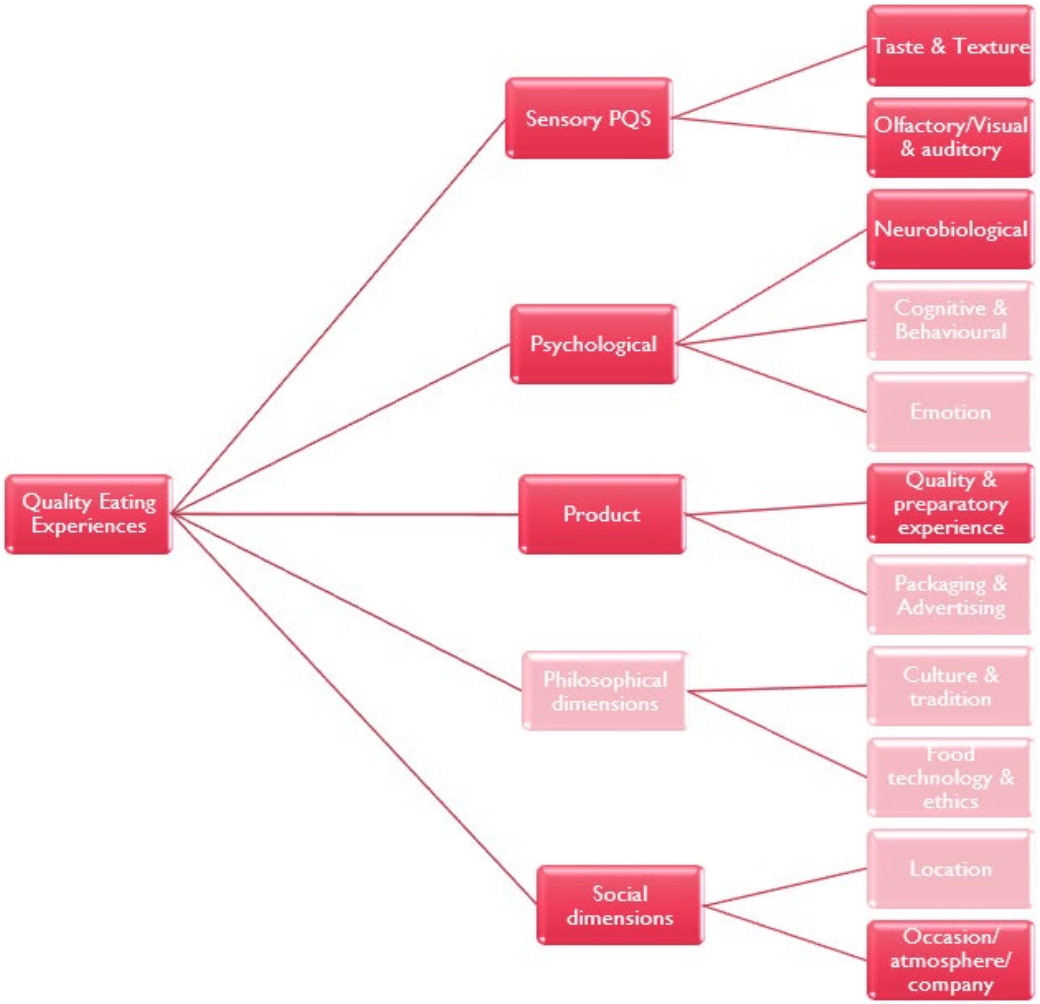


Figure 3b. Sub-strategies – Quality Pork Eating Experience Portfolio

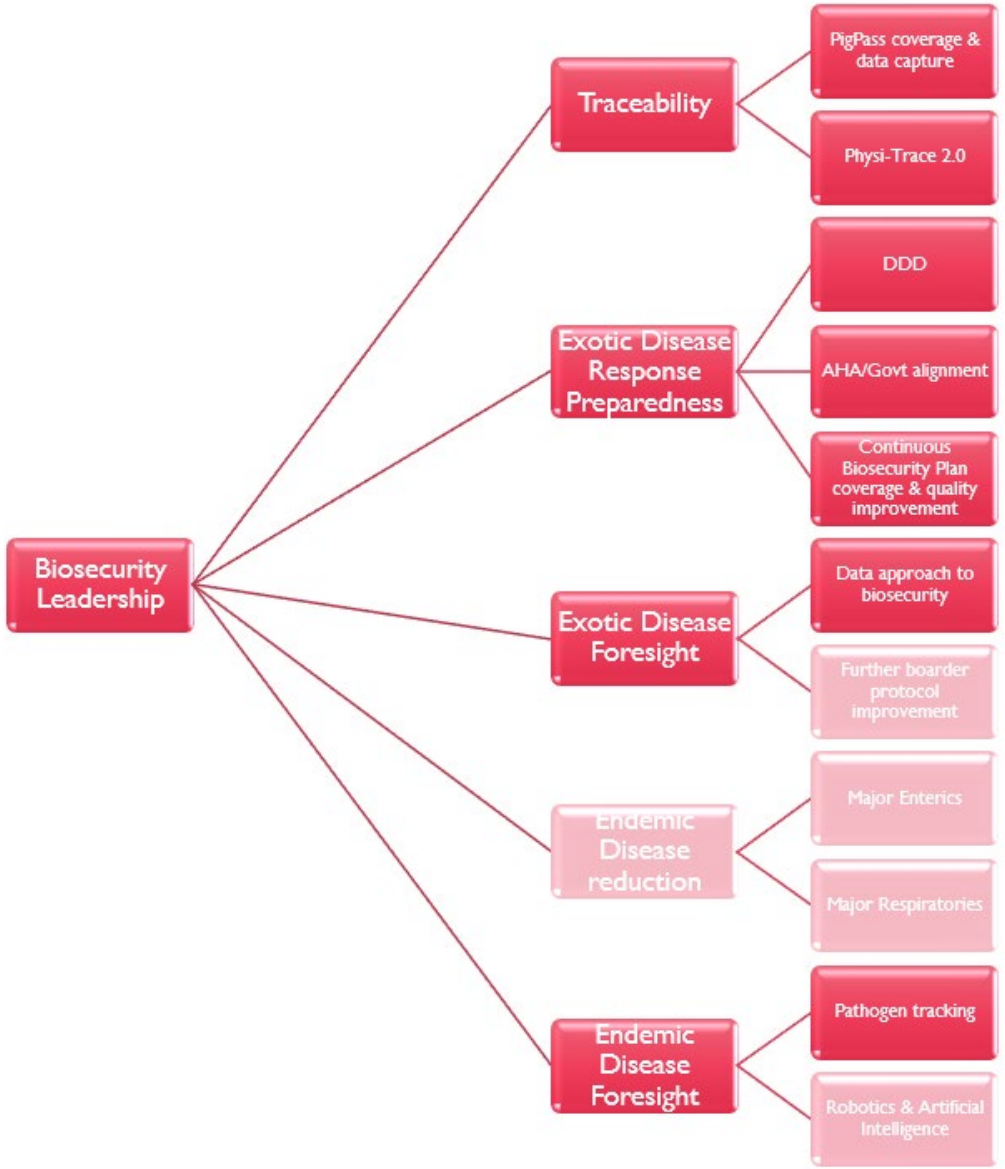


Figure 3c. Sub-strategies - Biosecurity Leadership Portfolio

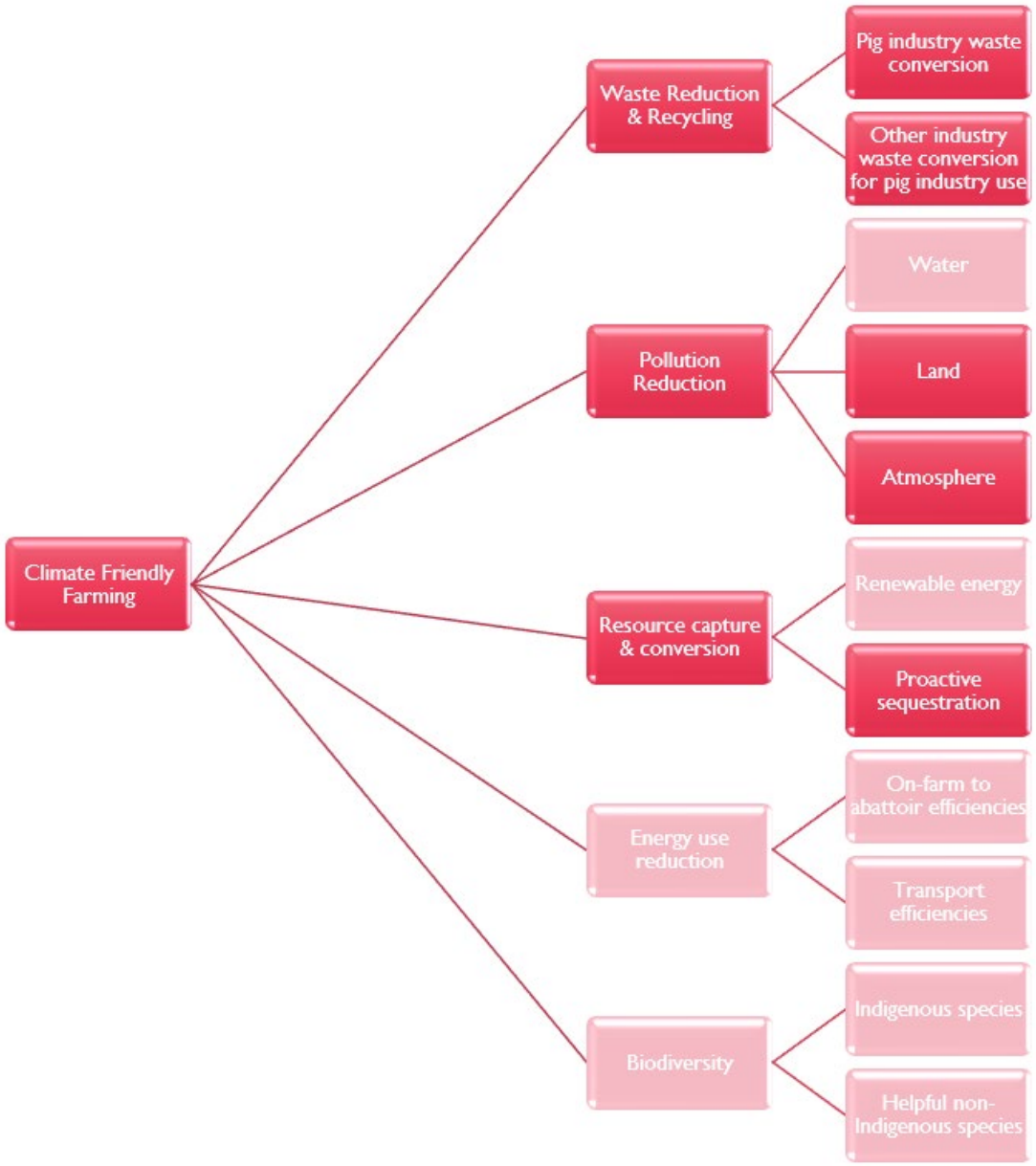


Figure 3d. Sub-strategies – Climate Friendly Farming Portfolio

INNOVATION PLAN – PORTFOLIOS OF STRATEGIC INTENT

PORTFOLIO 1 – REDUCE COST OF PRODUCTION AND PROCESSING (COP&P)

1.1 Diagnosis

It is estimated that USA cost of production (COP) is currently A$1.70/kg HSCW whereas Australian COP is circa A$2.80/kg. Australian processing costs are estimated to be circa A$1.00/kg HSCW with USA being approximately half of that. Whilst it may seem ambitious to strive to be on a competitive cost level with these global pork suppliers, being able to address producer and processing costs has, and always will be, a major objective of producers. Addressing costs and especially grain costs and supply requirements focuses on our volatility of grain price and pork price which has long been a pattern in Australia. It is also a well accepted that increasing productivity and throughput is a long term means to reduce production costs. Reducing costs through productivity improvements also contributes to societal values of efficient meat production using fewer resources per sow, whilst improving Animal Health has welfare advantages.

The value of this Horizon workstream is that is an enabler to diversifying markets. Costs of production and processing in Australia appear to be over 70% higher than the "lowest cost producer" nation overseas for which we have information. This premium severely limits our capacity to compete effectively with other sources of pork, both imported into Australia for manufacturing into smallgoods, and competing export markets. To give context to the size of this opportunity, there are just over 12 million tonnes of pork internationally traded in 2020, of which Australia had 0.3% share, in addition, there are a potential additional 200,000 tonnes of business available domestically.

Success in this Horizon will broaden the number of geographic markets and categories available to and enable us to spread risk and hence to managing volatility in the producers trading environment. There are opportunities not only for pork products and carcasses overseas but also genetics and breeding stock. If we are ever going to venture into genetic supply as a diverse market opportunity, we will also need to be free of disease and have comparable genetics to overseas genetics suppliers.

1.2 Strategy – Research and Innovation options considered and selected for FY2022

The options that are recommended to make up the COP portfolio are summarised in Figure 3a above, with those being recommended for the AOP 2021/22 being the highlighted boxes.

The strategic focus for research will be to address the main contributors to COP on farm. These are feed costs, animal health and weaned per sow productivity improvements. The contribution of these to farm COP is assumed from modelling exercises as follows:

- A reduction of diet costs by $10/t has a saving of 4c/kg
- A reduction of post-weaning loss by 15% has a saving of 8c/kg.
- A 5% improvement in HFC due to better FCR, better feed delivery and heavier carcass wt (+5kg) has a saving of 27c/kg.
- An improvement of productivity to increase WPS by 1 weaner/sow/year has a saving of 4c kg COP per annum.

Even modest improvements in these three areas alone have potential to contribute 15-20c/kg COP per year with adoption. There is also a substantial focus by Producer Relations in FY2021 on extending and adopting known research outcomes, from APL and APRIL research projects, that improve productivity and HFC.

On Farm and Processing costs will also be reduced through heavier carcass weights. At the start of 2021, the change in retail price grids has realised increases of 2.5 kg HSCW after they increased minimum weight by 5 kg from 60.0 kg on their price grids. As part of an overall strategic direction to increase carcass weight whilst remaining acceptable to retail and manufacturing markets, heavier carcasses will improve efficiencies within the Processing sector as well, given most costs are fixed overheads.

1.3 The SMART objectives for FY2022 financial year

1. The COP&P portfolio that is capable of delivering post-adoption $0.20/kg in reduced costs of production and processing by 30 June, 2022.

2. 85% of the COP&P projects by 2025 are on or ahead of milestone schedule.

It is clear that whilst many improvements have been made (such as the husbandry solutions to group housing which have largely countered cost increases versus gestation stalls), a broader array of inputs and innovation sources is required. As such, this Horizon will include both Research Network and Business Innovation idea sourcing.

1.4 Tactics – Planned Actions

Planned actions include research projects which are sourced through the R&I experts, and business innovation initiatives which are sourced by external parties co-ordinated via the EGM Operations. The actions also include the planned adoption priorities led by our producer relations experts. Finally, adoption and benefit measures will also be outlined by the producer relations experts. The APL Innovation Plan will be delivered through a focused research program, on-fam demonstration of available technology and encouragement of best-practice adoption. It will be measured through Benchmarking and reviewed and improved as new knowledge and technology becomes available and evolves.

The options that are agreed have an outline Tactical plan in this document for each selected strategic intent in the 2020-25 Strategic Plan. For lowering COPP portfolio, the justification or diagnosis, the strategy and Research and Innovation Plan for FY2022 is presented in Table 1.

Table 1. Reducing farm processing COP through strategic focus of R&I program. (Further detail on specific research projects are provided in Appendix II).

Justification through diagnosis	• *Reducing costs is best achieved through productivity* • *Animal health, feed grain availability contribute most to cyclical volatility* • *Genetic progress within Australia, especially in sow productivity, is slow* • *Processing costs would be reduced through greater volume throughput and larger carcases*
Strategy	• *Develop projects in Horizon Animal Health Program for early disease diagnosis; long lasting vaccines; long lasting disinfectants* • *Target investment into APRIL to deliver farm cost solutions* • *Develop projects in Horizon Feed Cost Program* • *Collaborate with other livestock industries in AIA to enable feed grain imports* • *Through Processing Portfolio identify grading measurement strategies to allow carcass weight to increase with minimal impact on carcass value*
Innovation Plan – FY2022	• *2-3 Horizons projects into Animal Health ($340k) to compliment PMP ($360k)* • *2-3 Horizons projects into Feed Costs ($300k)* • *Horizons WPS Program workshop and concepts ($110k)* • *Co-investment into APRIL ($950k)* • *Co-investment into Base Funding for Flexible Production Research projects to ($456k)* • *Co-investment with APRIL into post graduates ($147k)*
Budget FY 2022	• *$2.75m*

1.5 Research projects already identified for Animal Health include:

- *2019/0033 Early detection of multiple pathogens - Genics Pork Multipath project (PMP)* (Phase 1 due for completion June 2022.
- *Extending single shot vaccine efficacy through selected adjuvant technology* (Request for Proposal)
- *Reducing pathogen load in piggeries – Review and demonstration of new disinfection and cleaning procedures* (Request for Proposal)
- *The use of smart technology to identify early health alerts (*Request for Proposal)

1.6 Research projects proposed for reducing Feed Costs include:

- The validation of AUSCAN NIR technology for food waste sources (Request for Proposal)
- Reducing moisture content in food waste streams to <10% (Co-investment with Fight Food Waste CRC)
- Relaxing importation protocols of feed grains/ingredient through effective biosecurity controls (Co-investment with other RDCs through AIA)
- Improved FCR through genome modulation (Request for Proposal)
- In-line effluent monitoring for management advice (EMMAs) to identify feed wastage occurrence (Project to commence in July 2021)

Further ideas for projects addressing the limitations to weaned per sow (WPS) will be developed in FY 2022 following a Design Led ideation workshop by August.

PORTFOLIO 2 – INCREASING DEMAND THROUGH QUALITY and MEMORORABLE PORK EATING EXPERIENCE

2.1 Diagnosis

Measurement of failure rates has been in tracked for all meats since 2015 through *Insights* marketing R&D. Based on the last three meals consumed of each meat the percentage of consumers eating pork who reported that they had a bad experience with the meal increased from 14% in 2015 to 21% in 2020. This increase was pork "failure rate" was more than beef (10-14%) and chicken (8-15%). To drive more demand for pork, the industry needs to address critical risk factors associated with unacceptability. The *Insights* data identified that for pork, the bad experience for the consumer was expressed principally due to dryness, toughness, flavour, fattiness and smell. Some of these can be addressed through Marketing R&D and consumer education campaigns, such as *6-2-2* for pork loin steaks and cooking instruction guidelines on pack and point of sale (POS). Several key risk factors remain under the control of the industry. These include management of sexes and the elimination of boar taint; genetics for meat quality such as intramuscular fat and fatty acid profile which affect eating quality characteristics of dryness and flavour; husbandry and transportation guidelines to minimize animal stress in the final weeks of growth, transport and in lairage; stunning technique; chilling management; packaging methods.

APL and the pork industry have previously invested in understanding some of the key factors associated with sensory measured eating quality. A Pork Quality Score (PQS) system was proposed in 2018 which is designed to provide a simple measure of eating quality through the identification of contributing farm, processing and consumer cooking factors in a matrix, such that pork cuts could be promoted for quality attributes, thereby reducing "failure rates" in quality supported supply chains.

The Innovation Plan for Quality Pork Eating Experience combines the strategies around PQS, marketing consumer education and meat science. As a Strategic Intent into Eating Quality, this Horizon program will deliver pork that is sought after for consistency of taste, flavour and high acceptability ("Failure rate" less than 14%). The Innovation Plan for Quality Pork Eating Experience will address both pork failures at one end and improving memorable eating experiences at the other, as both end of the distribution impact on repeat purchase of pork.

2.2 Strategy – Research and Innovation options considered and selected for FY2022

The options that are recommended to make up the Quality Pork Eating Experience portfolio are summarised in Figure 3b above, with those being recommended for the AOP 2021/22 being the highlighted boxes.

The strategic focus for R&I will be to address the main contributors to consistency and eating quality on farm and in processing. These are the correct and wider use of Improvac; the quantification as to sensitivity to sensory of IMF as a genetic and nutritional selection trait; reducing carcass pH variance; improved meat quality through muscle fibre characteristics; quantifying the sensory value of pork that meets a PQS score of 65 or above. Through this program, marketing of quality attributes will be considered and educational programs developed. As with each Horizon program the scope of the program will be developed in consultation with the Board.

2.3 The SMART objectives for FY2022 financial year

1. Increase fresh pork consumption to an average annual of 11 kg per capita.
2. 85% of pork carcasses assessed in the supply chain to have a PQS score of 60 or above.
3. Identify the 3 most powerful differentiators between good meals (7-8.5/10) vs great meals (8.5-10/10)

2.4 Tactics – Planned Actions

Planned actions include research projects which are sourced through the R&I experts, marketing experts and business innovation initiatives which are sourced by external parties co-ordinated via the EGM Operations. The actions also include the planned adoption priorities led by our producer relations experts. Finally, adoption and benefit measures will also be outlined by the producer relations and through market R&D and *Insight* reporting. The APL Innovation Plan will be delivered through a focused research program, on-fam demonstration of available technology (for farm sector dependent technology and innovation) and encouragement of best-practice adoption through processors and the wider supply chain. It will be measured through Benchmarking and reviewed and improved as new knowledge and technology becomes available and evolves.

The options that are agreed have an outline Tactical plan in this document for each selected strategic intent in the 2020-25 Strategic Plan. For the Quality Pork Eating Experience portfolio, the justification or diagnosis, the strategy and Research and Innovation Plan for FY2022 is presented in Table 2. There has already been some investment into research projects which address the Pork Quality and Eating Experience portfolio, as indicated below Table 2.

Table 2. Improving Quality Pork Eating Experience through strategic focus of R&I program. (Further detail on specific research projects are provided in Appendix III).

Justification through diagnosis	• *High pork failure rates due to lack of moisture, boar taint and toughness.* • *Need to avoid metabolic disorders e.g. woody breast, white striping in chicken* • *Provide confidence of PQS through consumer sensory* • *Establish eating quality data from a variety of cuts out of heavy carcasses* • *Need to build on PQS system to improve predictability*
Strategy	• *Develop R&D into cause of metabolic indicators related to current genetics* • *Explore and quantify importance of IMF (and other traits) in Aust. genetics* • *Develop Horizons Program concepts from ideation sessions (existing and new)* • *Engage with stakeholders at each point of supply chain to develop benefits*
Innovation Plan – FY2022	• *Research into muscle fibre type and metabolic disorders in pork of low quality and assessment of potential genomic improvements. $300k (includes committed Base Funding EQ projects)* • *Sensory program into qualifying the PQS scoring system $225k* • *IMF sensory studies $150k* • *Road map for Australian ham and bacon manufacture $25k*
Budget FY 2022	• *$700,000*

2.5 Research projects already identified for improving Quality Pork Eating include:

- *2020/0003 Investigating the psychosocial, behavioural and emotional impressions of memorable eating experiences.* (Completed Feb 2021)
- *2019/0015 National pH audit*

2.6 Research projects proposed for addressing meat and sensory eating quality in FY 2022 include:

- Sensory evaluation of pork with PQS of 65 – entire male free, carcass pH 5.50-5.90, moisture infused loin and leg steak, recommended cooking instructions
- Quantifying the level of intramuscular fat (IMF) required to improve sensory experience in Australian pork supply chains
- Understanding the role of muscle fibre in pork in contributing to water holding capacity, tenderness and other sensory attributes of quality pork
- Establish datasets to expand PQS inputs to cover IMF, shelf life, flavour profiles

Further ideas for projects addressing meat quality and memorable eating experience will be developed in FY 2022 following Concept Scoping in July.

PORTFOLIO 3 – DEMONSTRATING BIOSECURITY LEADERSHIP

3.1 Diagnosis

The biggest risk to Australia's pork supply chain for domestic and export markets is an interruption and loss of pigs due to an unforeseen disease outbreak. In an external report, it has been estimated that ASF could cost between $670 to $877m for a low spread and up to $2b for a high spread scenario (Acil Allen, 2019). With the global African Swine fever (ASF) threat present since 2018, the Australian pig industry has had to contend with its greatest exotic disease challenge in its history. Over the last three years, APLs engagement with government at state and national levels and those within its industry has escalated, with its current position within the agricultural sector recognized as being the leading single industry body addressing an exotic disease threat.

The continued establishment of biosecurity leadership in the pig industry remains a major priority with APL. There are considerable knowledge gaps that exist for many exotic diseases apart from ASF, and being prepared for different Emerging Animal Diseases (EAD) and endemic diseases within Australia is recognized as needing further R&D investment. Biosecurity Leadership as a Strategic Intent is designed to be long lasting and address all major disease threats to the pig industry.

One of the major hurdles to disease preparedness is industry apathy and de-sensitisation to threat of a disease incursion. Both investment on farm and within structural frameworks of the engagement process is for insurance against risk. There are some additional benefits that can be achieved in terms of herd productivity and market access, but often these benefits are overlooked or under-valued.

The R&I program aims to deliver technical expertise and input into AUSVETPLAN manual updating and writing as well as solutions for industry on how to firstly prevent an EAD outbreak on Australian soil, secondly to have up to date information and strategies for on-farm and pork-supply chain preparedness, and finally to identify and develop strategies that allow for a swift and successful response by the pig industry to any EAD event. This R&I Biosecurity Leadership strategy is done in combination with an integrated APL Policy approach to biosecurity; extension and adoption by Producer Relations; and effective Communications with government, community, consumers other stakeholders.

3.2 Strategy – Research and Innovation options considered and selected for FY2022

The options that are recommended to make up the Biosecurity Leadership portfolio are summarised in Figure 3c. Those activities prioritised for the AOP 2021/22 are represented by highlighted boxes.

The Biosecurity Leadership positions include:

- Lead Cross-sectoral collaboration to improve government responses to Animal Health threats – *Exotic disease response preparedness*
- PigPass App and increased disease surveillance - *Traceability*
- Pushing back the borders data-driven biosecurity – *Exotic disease foresight*
- Best Practice ASF Industry planning - *Exotic disease response preparedness*
- Reducing the spread between farms from endemic disease – *Endemic disease foresight*

3.3 The SMART objectives for FY2022 financial year

1. Zero Exotic disease outbreaks.
2. 85% of the Biosecurity Leadership projects are on or ahead of milestone schedule
3. Identify one additional route to a biosecurity leadership position (in addition to data driven biosecurity and PigPass App potential leadership positions).

3.4 Tactics – Planned Actions

Planned actions include research projects which are sourced through the R&I experts, herd health experts via the ASF Industry Technical Panel, experts and businesses from overseas who have dealt with exotic diseases and pandemics including COVID-19. The actions also include the planned adoption priorities led by our Policy and Producer Relations Teams . The APL Innovation Plan will be delivered through a focused research program, on-fam demonstration of available technology (for farm sector dependent technology and innovation) and best-practice adoption through processors and the wider supply chain. Through active involvement and initiation of government activities, such as regular updates to the AUSVETPLAN manuals by the AHA Writing group, AHC participation and reporting of research outcomes and DAWE, our Leadership position will continue to be recognized and an effective means of providing confidence in our pork supply chain to domestic and export markets, and government audiences.

The options that are agreed have an outline Tactical plan in this document for each selected strategic intent in the 2020-25 Strategic Plan. For the Biosecurity Leadership portfolio, the justification or diagnosis, the strategy and Research and Innovation Plan for FY2022 is presented in Table 3.

Below the table is the project descriptions of funded projects into ASF and Biosecurity Leadership that are either completed or in progress. This indicates the priority of ASF Preparedness and Biosecurity in general that has been undertaken by R&I in the last 18 months.

Table 3. Providing Biosecurity Leadership through strategic focus of R&I program. (Further detail on specific research projects are provided in Appendix IV).

Justification through diagnosis	• Greatest threat to Australian Pork industry is a break in biosecurity • Investment is insurance against business interruption • Need to expand disease preparedness capability beyond ASF
Strategy	• Provide unified knowledge to industry and government • Invest in knowledge gaps • Develop new technologies that assist in risk prediction and supply chain management during an EAD response
Innovation Plan – FY2022	• Committed Truck Wash Stage 2; DDD Stage 2 ($233k) • Visitors app and Animal movement commercialisation with Exoflare ($250k) • Pathogen surveillance and PCR point of contact testing with AHL/Genics ($75k) • DDD Composting trial ($71k)
Budget FY 2022	• $628,500

3.5 Research projects already identified for Biosecurity Leadership include:

- *2018/0035 Consultancy for Chair Biosecurity Strategic Review Panel – Dr Gardner Murray* (Completion due June 2021)
- *2019/0040 Consultancy for Chair ASF Industry Technical Panel – Dr Ross Cutler* (due for renewal June 2021)
- *2019/0032 Development of decision support tools for on-farm mass herd euthanasia, disposal and decontamination (DDD) – Stage 1 Literature and case study review* (Completed Nov 2020)
- *2020/0069 Development of decision support tools for on-farm mass herd euthanasia, disposal and decontamination (DDD) – Stage 2* (Completion due March 2022)
- *2020/0005 Create and validate best practice truck biosecurity and disinfection guidelines with practical application – Stage 1 Literature review.* (Completion April 2021)
- *2020/0001 DAWE supported ASF Liaison Officers.* (Completion due October 2021)
- *2020/0042 HOGGONE sodium nitrite effectiveness study for mass destruction.* (Completion due June 202)
- *2020/0004 Data driven biosecurity – Stage 1 scoping phase* (Completed Nov 2020)
- *2020/0033 Driving borders back – Animal Movement app development Exoflare Stage 2 Pilot.* (Completion due June 2021)

3.6 Research projects proposed for addressing ASF, disease surveillance, and on farm biosecurity management in FDY 2020 include:

- Practical techniques and demonstration for mass disposal of pig carcasses on farms. NSW DPI co-invested project (Completion expected July 2022).
- Exotic pathogen surveillance at point of contact on farm. Joint project with AHL and Genics.(Completion 2022)
- Commercialisation rollout of Exoflare visitation and truck movement mobile apps (Completion June 2022)

PORTFOLIO 4 – CLIMATE FRIENDLY FARMING

4.1 Diagnosis

The community expectations for sustainable farming practices have long been recognized within the pig industry. With recognition that the livestock industry contributes towards green gas (GHG) emissions and impacts on climate change, the pig industry has an opportunity to promote itself as a responsible and environmentally sustainable industry. Livestock account for around 15% direct contribution of the global GHG emissions, with most of the world's methane coming from livestock. In Australia, livestock industries contribute 10% to the national GHG emissions, with 56% of methane and 76% of nitrous oxide produced from livestock. The Australian pork industry has a role in reducing emissions via resource conservation and by productively utilising waste streams, generating energy and heat from effluent via biogas capture, and using nutrients within waste streams as a renewable fertiliser (thereby displacing the production of energy-intensive fertilisers). This aligns well with programs stemming from the states' emissions reduction policies, many of which relate to energy ('renewable', 'clean', 'efficient' 'savings', affordable' being common adjectives). Pig production produces approximately one fifth of the methane produced from cattle, so on an animal protein basis, pork production has many sustainable attributes.

Following an external report into Environmental and Policy issues Relevant to the Pork Industry (Integrity Ag and Environment, 2021), there are key recommendations that would position the pork industry favourably in terms of carbon and utilisation of food waste streams from landfill (which generates methane), and the recovery of nitrogen, phosphorus and potassium to reduce inorganic fertilizers. With the success of biogas digestion as a means to trap methane from effluent streams and re-use energy from methane to replace gas and electricity, there are potential savings to pig producers on operating costs as well. It has been estimated that biogas payback on investment is achieved with 5-6 years for a 550 sow piggery, and 2-3 years for larger operations (*APL project 2018/0032*; Tait and McCabe, 2020).

The 2020-25 Strategic Plan identified that APL are committed to delivering improved environmental credentials within the industry. This starts with measurement of nutrient utilisation, including water, GHG emissions and soil carbon. Through measurement, benchmarks can be established such that quantifiable progress can be monitored and improved through innovative technologies including biogas, renewable energy such as solar and wind, and waste management utilisation including insect farming and food and by-product waste.

4.2 Strategy – Research and Innovation options considered and selected for FY2022

The options that are recommended to make up the Climate Friendly Farming portfolio are summarised in Figure 3d. Those activities prioritised for the AOP 2021/22 are represented by highlighted boxes.

The Climate Friendly Farming positions include:

- Preparing the industry with a suitable direction for environmental claims on carbon, methane reduction and food and by-product waste utilisation
- Developing strategies of measurement and establishing benchmarks for Climate Friendly Farming credentials.

- Improve accuracy and adoption of nutrient models for use by producers and regulators.
- Invest in research projects that contribute to more accurate information for policy makers.

4.3 The SMART objectives for FY2022 financial year

1. Establish 3 social leadership positions in environmental sustainability
2. Establish a set of measures and targets for carbon status and waste utilization
3. Commence benchmark reporting from commercial producers representing 25% of industry.

4.4 Tactics – Planned Actions

Planned actions include research projects which are sourced through the R&I experts, herd health experts via the ASF Industry Technical Panel, experts and businesses from overseas who have dealt with exotic diseases and pandemics including COVID-19. The actions also include the planned adoption priorities led by our Policy and Producer Relations Teams.

Table 4. Measuring, Benchmarking and improving Sustainable credence through Climate Friendly Farming.

Justification through diagnosis	• Pork industry can be demonstrated to be to be carbon zero • With further investment, industry could be used to offset C polluters and become carbon positive • Need to validate the industry performance for GHG, water and nutrient balance
Strategy	• Validate, extend and adopt resource utilization models by producers • Extend, adopt and support renewable energy and water re-use at farm level • Develop strategies towards delivering carbon positive and zero waste on farm • Develop and demonstrate benchmarking measures to report continuous improvement
Innovation Plan – FY2022	• Develop strategies to implement road map recommendations for achieving carbon positive; waste utilization ($48k) • Committed projects EMMAs to predict feed wastage, Black Soldier Fly project, Bubble column ($316k) • Commence Horizon planning into Climate Friendly Farming ($110k) • Validate and up-load Enviro spreadsheet models and develop extension material for end-users ($50k) • Engage LCA consultant to benchmark 20% of industry ($246k)
Budget FY 2022	• $770,000

4.5 Research projects already identified for Climate Friendly Farming include:

- 2020/0023 Assessment of environmental and policy issues relevant to the pork industry (Completed Feb 2021)
- 2020/0019 Consultancy Anwen Lovett Climate Research Strategy for Primary Industries (CRISPI) (Due for renewal Sept 2021)
- 2019/0027 Closing the loop: Black soldier fly technology to convert ag waste into high quality fertilizer and soil improvers (Completion due Feb 2022)

4.6 Research projects proposed for addressing Climate Friendly Farming in FY 2022 include:

- Establish a road map through external consultancy towards objectives and strategies to Carbon positive (Completion July 2021)
- Establish a road map through external consultancy towards objectives and strategies to zero waste (Completion July 2021)
- Benchmarking LCA for piggeries (targeting 25% of industry by June 2022)
- Update spreadsheet models including PigBAL, WatBAL for cloud based accessibility (Due for completion Aug 2021)
- Validation of environmental models for benchmarking purposes

INNOVATION PLAN – DIVISIONAL PORTFOLIOS

In addition to the four identified Strategic Intents above, there are three other R&I portfolios where Research and Innovation Planning occurs. These are:

5. Traceability and Integrity
6. Processing for upstream value
7. Welfare and Antimicrobial (AM) Stewardship

In the following pages, each portfolio will be summarised by their own Strategic Plan (Tables 4-7). These portfolios have a number of Solutions projects already underway and proposed for the next 12-18 months. Some of these research projects may cross over into proposed Horizon programs (eg. Processing Solutions projects may contribute towards Quality Pork Eating Experience Horizons; Traceability projects could cross over into Biosecurity Leadership Horizons). The Innovation Plan within each portfolio is only identified for the next 12 months and as new ideas become available, it is anticipated that more Solutions projects will be able to be funded so long as they meet prioirties, succeed through the review process and Investment Committee recommendation and fit within the AOP budget. Some of the Solutions projects may also fit within the Base Funding arrangements for Flexible Production Research within approved Base Funded Providers. This will maximise co-investment with Base Funded Providers and promote commercial validation and industry adoption.

PORTFOLIO 5 – TRACEABILITY AND PRODUCT INTEGRITY SYSTEM CAPABILITY

Table 5. Conduct and increase capability of PhysiTrace and product data integrity

Justification through diagnosis	• Provide a world class pork traceability platform • Be able to identify CoOL claims for smallgoods, ham and bacon as well as fresh pork • Support Australia Pork brand marketing
Strategy	• Regular test samples from abattoirs and small good manufacturers • Maintain a library of PhysiTrace datasets which is current • Reduce the sampling and trace back cost without losing accuracy
Innovation Plan – FY2022	• Committed Operational PhysiTrace testing to allow 5 trace backs per year • Develop technical support in house • Collaborative R&D with other traceability platforms and utilize smart learning technology to reduce traceback costs
Budget FY 2022	• $130,000

Table 6. Preparing Processing for new grading systems which realize full carcass value and developing non-pork products for market volatility regulation.

Justification through diagnosis	• Insufficient short-term markets of value to allow for oversupply • Carcass value grading no longer appropriate for portioning plant efficiency • Heavier carcass weights will change retail cuts • Need to maintain processor/wholesaler returns on boneless rindless pork
Strategy	• Divert excess carcasses into high value non-pork products • Identify opportunity and hurdles to measuring carcasses based on LMY or primal leanness for portioning. • Crunchy crackling options for rindless pork - scope for 2022/23
Innovation Plan – FY2022	• Commercial partnerships to produce high quality high value oil, protein, collagen and calcium $160k • Develop grading algorithms to predict LMY predictions with PorkScan and Frontmatec and relate to P2 $130k • Committed grading improvements AlmTech II $60k
Budget FY 2022	• $360,000

Table 7. Identifying and developing strategies and practical on-farm solutions that address animal welfare concerns and AMS through antimicrobial resistance research.

Justification through diagnosis	• Community expect low or no antibiotics and high animal welfare values • No transparency in national reporting of AM usage or the drugs being used • Retail customers and select markets overseas are looking for clean, green food
Strategy	• Develop and implement new production systems and benchmarked AM usage that address welfare of pigs and antimicrobial stewardship • Report as an industry the progress towards AM Stewardship and educate the community of the responsible use of medication for animal welfare outcomes. • Engage with responsible interest groups who support our shared values
Innovation Plan – FY2022	• Committed projects AMR testing and reporting, PhD at Murdoch ($165k) • Committed Animal welfare in APRIL ($50k); Pig Tails project CRC-p ($50k) • Gene sequence identification of AMR resistance by mycoplasma ($75k) • Implement a National reporting database for antimicrobial on farm usage and begin reporting participation rates $0k[I]. • Invest in AMR (antimicrobial resistance) research as Solutions projects $0k[I] • Invest in Solutions to identify freedom movement farrow pens for future MCOP $0k[I]
Budget FY 2022	• $340,000

[I]Indicates that the identified tactic has not been budgeted for at the present time.

APPENDIX I

THE INNOVATION PLANNING PROCESS

Author:	|Dr Rob Smits GM Research & Innovation
Date Paper Written / Last Updated:	|7 January 2021
Date of presentation to Board Meeting:	|TBC

Purpose:

To document APLs Innovation Plan and describe in detail for future reference the Innovation Planning Process for a complete understanding by the Board, APL, Producer Members and Researchers.

Recommendation:

The Board Accepts this document as the approved Research and Innovation Plan 2020.

Background:

In early 2019, APL completed a review of its Research Development and Extension (RDE) Investment Model. The purpose of the review was to understand the strengths and weaknesses of the current model and to make recommendations about how to modernise the RDE investment processes to ensure best practice and access to open innovation opportunities both domestically and overseas. The review made several recommendations for improvement which are being implemented by APL, in particular a shift in the RDE portfolio to increase the focus on industry transformational opportunities beyond business as usual. It also identified opportunities for APL to expand its presence in research commercialisation and to drive profitability for the industry through marketing of new innovations in Australia and overseas.

APL's new model adopts a dual pathway approach – the first is RDE to support immediate industry needs and the second is RDE which takes an *innovation business development* approach. Under the new model, APL aims to grow its partnerships and co-investment with government, universities, CSIRO, international, and private sector both within and outside of the pig and pork industry to deliver transformational innovation which can then be demonstrated to be farm ready for pork producers.

For context, the **Solutions** portfolio will focus on responding to the immediate needs or known knowledge gaps of industry and will be open for proposals year-round and will have streamlined management and approvals. The **Horizons** portfolio will be comprised of a small number of Strategic Intents prioritised by the APL Board that will focus on delivering outcomes over a longer period (3-5 years) that support transformative changes to industry and lead to increased industry competitiveness through substantial reductions in cost, increased income, and new options for risk management. Innovation programs that clearly address each Strategic Intent will be identified and prioritised through a process of stakeholder consultation and engagement activities that will be externally facilitated. It is initially proposed that approximately 70% of research expenditure would be allocated to Horizon Projects and 30% to Solutions projects.

The Board has already established the new Investment Committee to replace the Research and Development Approval Committees and the Specialist Group system previously in place. That process effectively meant many of the organisations that benefitted from research funding were

involved in the allocation of resources. There was a governance risk to some degree with some participants (as producer, researcher, or acting on the behalf of both) having a conflict of interest. The creation of the new APL Investment Committee is seen as a more transparent governance model with the Committee adhering to defined Terms of Reference that is reviewed by the Board.

The role of the Investment Committee in relation to APL's investments are to:

- Ensure industry priorities align with Commonwealth Government's National Research Priorities and Rural Research and Development priorities;
- Oversee the implementation of APL's R&D investments in the Industry Solutions and Horizons model and non-R&D investments made within the Horizons stream;
- Critically evaluate the business plan for each funded Horizon program according to each Strategic Intent (within the Horizons stream) to allow a recommendation to be provided to the APL Board that the business plan be supported and required resources allocated;
- Evaluate the performance of APL's investment model, alignment with APL's Strategic Plan and progress towards milestones, budget adherence, key deliverables and investment value (with appropriate safeguards for commercially sensitive information) and report these to the APL Board; and,
- Is responsive to specific Board directives and provide feedback to APL Management for use in strategy development.

The delivery of the Innovation Plan which is the responsibility of the GM Research and Innovation will be to:

- Identify solutions that may already exist in other industries or disciplines that could be applied in the pork industry;
- Inform the Investment Committee and Board of potential new Strategic Intents for new technologies and investors;
- Broaden networks and knowledge, including staying on the cutting edge of potential technology and research findings;
- Develop and manage the research capacity and capability to deliver quality research outcomes in a timely and cost-effective way that forms part of the Innovation Plan for the delivery and adoption of impactful outcomes;
- Broaden innovation and research participation to be across the supply chain and other industries within Australia and overseas that share similar challenges or opportunities;
- Encourage and engage producers during the Innovation Planning to garner some insight into defining industry challenges, support for potential innovative solutions and adoption considerations on their farms.

In 2020/21, the Investment Committee and Board recommended the Strategic Intents of high priority were:

1. Improving the Eating Quality to drive demand
2. Establishing Leadership for industry Biosecurity
3. Reducing Costs of Production and Processing

From an operational perspective there were additional opportunities not highlighted in the review but never-the-less, significant opportunities for continuous improvement. These included:

1. Measuring the outcomes of the R&I programme.

2. Making the R&I program managers responsible for their programmes plans, portfolios and outcomes.

3. Leveraging specialist skill sets in APL so that those skilled and managing researchers create the insights and those skilled at communicating, commercialising, and extending get those insights adopted.

This document will explain in depth the processes that will be involved in executing the APL Innovation Plan. As the APL Board have already accepted the Innovation Plan (November 2020), this document is intended to be used as a reference describing the Innovation Planning process, how it will determine the activities of the APL Research and Innovation Team, and act as the basis for Communications to others within APL, the wider research community and other industry stakeholders.

1. Details

The Innovation Plan detailed here describes the process from ideation and problem/opportunity identification for each Strategic Intent (Horizon projects) and the development of ideas through to the management of the research project. The Extension and Adoption phase will be described briefly here as this will be covered off in more detail by the Capacity and Capability Plan, the Extension and Adoption Plan and the Marketing Plan.

The R and I Team

This team currently has 5 members who are all experienced in their roles. All the team members have ongoing relationship with diverse groups of producers, researchers, and other industry stakeholders because of the current roles.

- Dr Rob Smits: General Manager Research & Innovation
- Dr Rebecca Athorn: Manager, Production Innovation
- Dr Vaibhav Gole: Manager, Integrity Systems and Capability
- Dr Lechelle van Breda: Manager, Production Stewardship
- Ms Gemma Wyburn: Climate Friendly Farming Program Leader

Innovation Planning Process

The creation of impactful industry outcomes will be developed through a process driven Innovation Planning Strategy that has the following objectives:

1. Clear identification of the underlying challenge or opportunity identified through producer and industry consultation;
2. An attitude of big picture thinking for the generation of research projects that contribute to significant gains in the industry's performance or public standing;
3. Research for industry adoption such that the financial investment benefits all producer members;
4. The development of a research program with objectives that underpins APL's Strategic Plan.

The initiation of new research projects will differ from what has been done traditionally at APL. In the past, Researchers would be invited to contribute research proposals that were set by four Specialist Groups 1). Market Development, 2). Production and Welfare, 3). Environmental Management; and 4). Biosecurity and Product Integrity. The research calls from within these groups would address key themes of industry, for example: Improving Animal Welfare; Reducing Cost of Production; Improving Environment; or Genetic Advancement. Approximately $5.5-6m was spent on R&D as an average over the past 5 years. The 2019 Review into Innovation and R&D concluded that funded research projects

were becoming of short-term duration to meet immediate or reactionary needs; were of an incremental nature, adding on small advances of knowledge to existing understanding; and the diversity of research providers being funded was declining. The conduct of research was also fairly inflexible, with an annual invitation for research proposals. Unlike the Pork CRC or APRIL who now invite submissions under four invited rounds (Industry Priorities projects; Transformation Projects; Innovation Projects; and Commercialisation Projects) APL research submissions were not characterised for different purposes, except for education scholarships or travel grants.

The recommended Innovation Plan which APL has adopted is aimed at firstly having a deeper understanding of the underlying causes of industry challenges from industry, and secondly having input from project participants that have a diverse technical background that can contribute to solutions and industry adoption of research outcomes. A new focus for the Horizons research program will be to conduct a comprehensive ideation session that precedes the invited call for research proposals. Sessions will be professionally facilitated and developed either on-line or face to face, or a combination of both. The overall Innovation process will follow a workflow that can best be described diagrammatically as Figure 1.

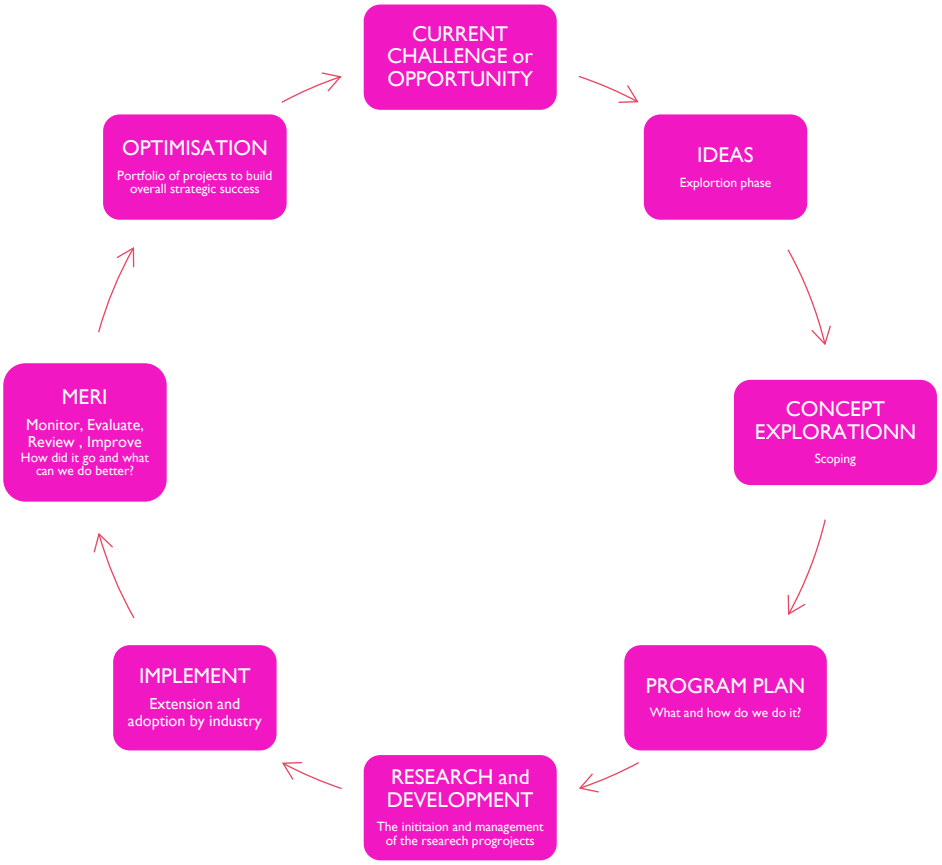


Figure 1. The APL Innovation Plan adopted for Horizon Research Programs

Central to the development of research and innovation that has impactful outcomes to industry is the need to develop the business case which address the market, is feasible to economically implement and is viable for industry to adopt. These three components are interrelated and the intersection where a concept or project delivers all three attributes will have the greatest likelihood of long-term success (Figure 2).

The initial phases of the Innovation Planning process will rely on Design Led thinking and Qualitative Evaluation of both participants and concepts. In marketing terms, innovation or brand failure occurs due to little or poor work effort done at the 'front end' of the Innovation Planning processes. Research

groups, such as MLA, are now adopting this type of approach to their R&D programs. Whether the project is a new product on a retail shelf, or a new strategy for reducing the need for antimicrobials, the identification of the challenge or opportunity and a process driven project management are similar.

The Innovation Process is not limited to the Horizon Projects, but it is more applicable to these larger, big-picture projects that need to address specific Strategic Intents.

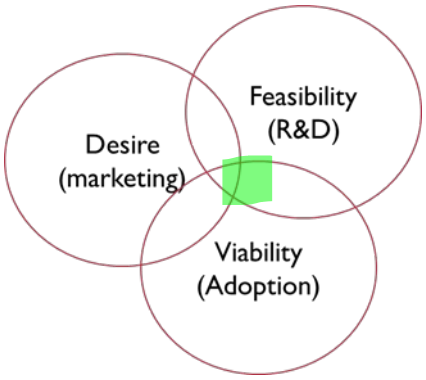


Figure 2. The delivery sweet spot for Innovation success

A number of models exist for innovative planning (Figure 3). One that gained popularity was developed adopted by the Design Council in the UK (2005) which was described graphically as a Double-Diamond, as it had the phases of Discover, Define, Develop and Deliver. The diamond shape was chosen as it represents the thinking process of divergence then convergence. Or in other words, go wide then decide. A further development of double diamond concept thinking is the Triple Diamond Process (Zendesk®) which adds more to the development and delivery of an Innovation Plan. The third diamond represents an agile iterative cycle at the beginning of research and development then fine tunes as the final product or strategy develops. The risk associated with R&D investment in the third diamond also decreases the closer to delivery of the final project outcome and goals.

By adopting this Innovation Plan process and adding effort and investment into understanding the true problems our industry faces and why, and secondly increasing the diversity of participants during the ideation stage, the StageGate approach to process driven research management will be enhanced. More importantly, the investment of time and money at the front end will help drive adoption and uptake after the research project has been completed. Adoption of research and realizing the research investment value has been low by the Pork Industry in recent years. This has been identified by APL in a recent report on Adoption and Commercialisation of a decade of Research Projects and will be addressed in the APLs Increasing Capacity and Capability Plan.

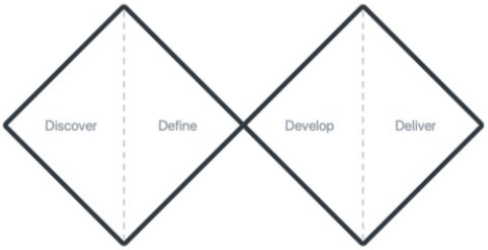


Figure 3a. Double Diamond process thinking (Design Council, 2005)

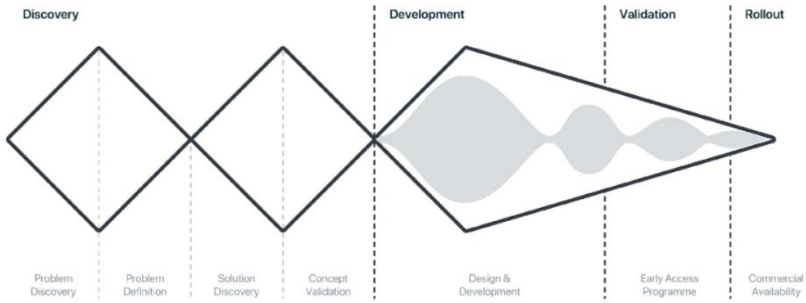


Figure 3b. Triple Diamond process thinking (Zendesk®).

This may seem a different approach to the traditional research application, but it should not be an unfamiliar approach. The APL Innovation Planning process uses proven methods of product and concept development undertaken in commercial business for many years and applies them to the research and innovation program. Researchers and scientist have always had to apply for funding and address certain guidelines in terms of meeting industry objectives, budgets and to be competitive. The APL Innovation process will now require research providers and scientists to collaborate with end users across industry as part of research proposal preparation for Horizon Programs. This will be facilitated by APL as part of the Research and Innovation program. It does not replace the research project development and it will not compromise experimental design and scientific rigour. Instead, this process provides a justification to producer members to invest large amounts of the research budget into certain projects that will deliver impactful outcomes to the pork industry. There will be greater focus on funding innovation projects that will deliver outcomes that are adopted by industry by the end of the Innovation cycle (Figure 1), and researchers will need to have a good understanding as to how their research would not only benefit the pork industry potentially, but also contribute to the development of a wide industry adoption strategy.

Based on the Double Diamond and Triple Diamond process thinking, there are four phases that can be applied to Innovation Planning. These are represented in Figure 4 as:

1. Discovery and Ideation
2. Development
3. Validation
4. Adoption and Improvement

1. Discovery and Ideation Phase

The first steps of the Innovation Plan are part of the Discovery phase and follow four phases as part of the Double or Triple Diamond process thinking (refer to Figure 3b). Problem or opportunity definition and ideation are at the beginning of the Innovation Planning process and needs to occur before the research phase. Successful industry innovation is largely dependent on understanding the underlying problem or opportunity that exists within industry and then creating an appropriate research program to address specific objectives as part of the strategic intent. Both APL Horizon and Solutions R&I will need to consider the concept of Ideation and the four phases detailed below. For *Solutions Projects* these are likely going to be completed by the researcher and/or the APL Research Directors as they identify the need to conduct their research to address defined industry knowledge gaps or ways to improve how things are done by producers and processors. For *Horizon Programs*, the use of Design Led Thinking workshops will be employed to fully understand and develop research projects that address the strategic intent.

The components of the Discovery ad Ideation Phase are:

1. Discovery
2. Distil and Define Opportunity
3. Ideate

4. Experiment or Scoping

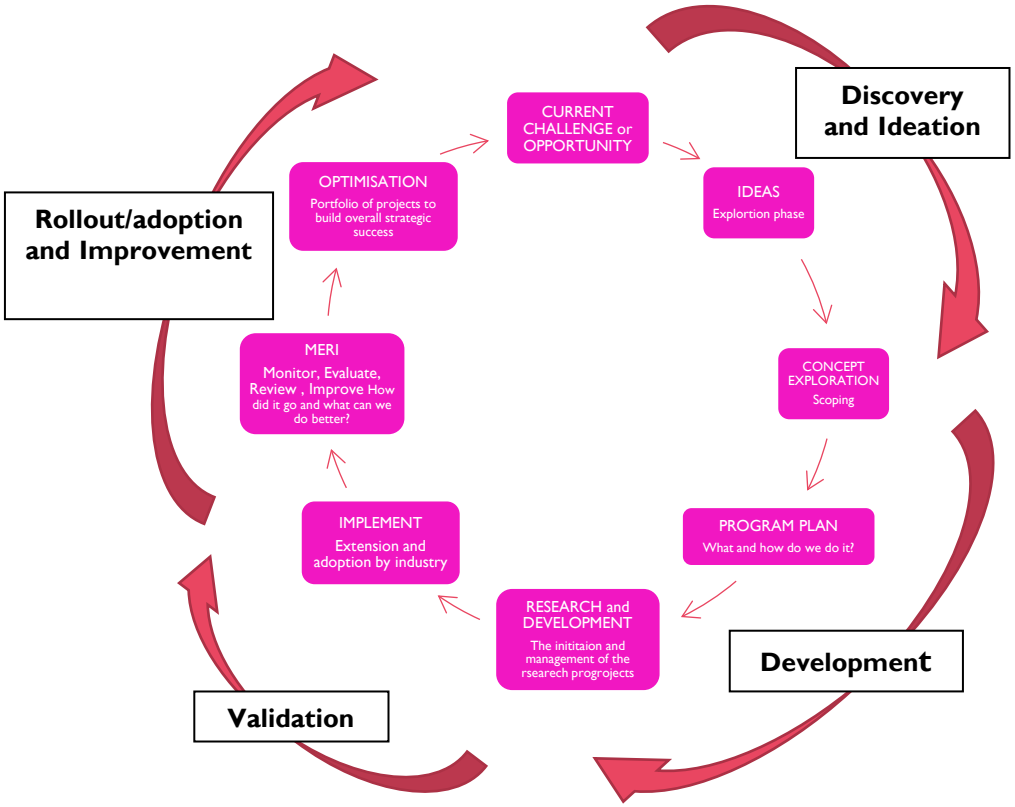


Figure 4 Combining Ideation, Research Development and Adoption into the APL Innovation Plan

Design Led thinking will include the creation and selection of Opportunities Areas which address the industry issue identified as the Strategic Intent. For one Strategic Intent (e.g. Reduce COP) there may be more than one industry issue that can be defined and focused on (i.e. Animal Health, Feed Costs, Reproductive Performance). These focus areas essentially become the Horizon Programs. They also form the priority for Industry Solutions to compliment the larger Horizon Programs as quicker and initial lower investment term projects that address knowledge gaps before committing large financial resources to new areas of research. This addresses the duplication of research that has been identified in the R&D model review. Duplication of research has occurred within APL over time, between APL and APRIL/Pork CRC, and between other industries (e.g. automation and ag engineering). By consulting widely and reviewing the literature and industry practices in the Discovery phase, a greater progress towards impactful outcomes will be achieved.

Design Led process activity can include qualitative research of stakeholders as part of a selection process to define the underlying issue and discover areas of opportunity on which to develop new ideas and creativity. It will be important to conduct a broad knowledge review from participants within the pork industry and those from associated backgrounds. The selection of producers, processors, customers, feed nutritionists, veterinarians, geneticists and researchers are part of the Discovery phase. Whilst researchers may have a wide scope of industry knowledge, it will be necessary to have

end users represented in the Discovery and Ideation phase so that innovation outcomes address the Strategic Intent that applies to the pork supply chain. Producers and other end users also contribute to the creation of Opportunity Areas which can be explored in the Design Led Workshops.

Design Led Ideation which address Opportunity Areas will develop creative ideas and then these will be distilled into prioritised concepts. Prioritisation will be qualitatively researched with stakeholders including end users and research providers. The shortlisted concepts can be developed as story books to assist in the Why, What and How the concept would be developed and practically adopted. Story Books, Concept Boards, Straw polls, Design Sprint sessions are part of the ideation and prototype development and provide a tangible concept which are important to both end users (producers and customers), and research providers. Concept boards and story boards should address the:

- Opportunity (positive outcomes expected that will address the Strategic Intent)
- Proposition (the Shark Tank approach, or concept pitch. Needs to be inspiring and bold)
- Reason to believe (for the reviewer or end user to be convinced of its worth and ability to deliver desired industry outcomes).

A concept brief is an important part of the Innovation Plan as it will address a desirable approach to combining different ideas *before* requesting research proposals. It is likely that for large Horizon programs to address a Strategic Intent there will be more than one research project that will ultimately deliver a transformational idea or solution to the industry. An important take-home point is that an innovation concept is *not* a research proposal. One or more research proposals will contribute to the innovation concept that in turn must address the Strategic Intent.

2. *Development Phase*

Concepts are important to *end user/producers* as part of the prioritisation of projects will be to evaluate a business case for potential return on investment. *Researchers* also need to have an informed background as to how they can design their experimental program, prototype/concept development and commercial evaluation plans. The Development Phase (Figure 4) covers the end of the Ideation and Design Led workshop review and the start of the Research phase.

Once Opportunity Areas have been developed, workshopped and shortlisted based on impact and risk, the concepts are then further assessed for desirability, feasibility and viability (Figure 2):

1. Desirability (popularity & marketability of outcome)
2. Feasibility (business case and ROI)
3. Viability (adoption rate & industry impact)
4. Program Planning
5. Research Program

The desirability of the concept is gauged as part of the Discover and Ideation phase. The desirability is determined from feedback and review of concept boards, or storyboards for more complex concepts or strategies, and prototypes if applicable.

The feasibility and viability of a concept is developed before the submission of a research proposal. It will need to be prepared as a Business Model. A combination of the widely accepted Business Model Canvas by Osterwalder and Pigneur (2010) is presented in Figure 5 with content suitable for APL Horizon concept reviews. The importance of each attribute is represented by the number in front of each box. It should be noted that as this is used for a review of the concept, it is not intended as a template for reviewing individual research proposals. It is important that the concept review is made available to researchers, as its used to develop the Program Plan and direct the Research and Development program addressing the concept (Figure 4).

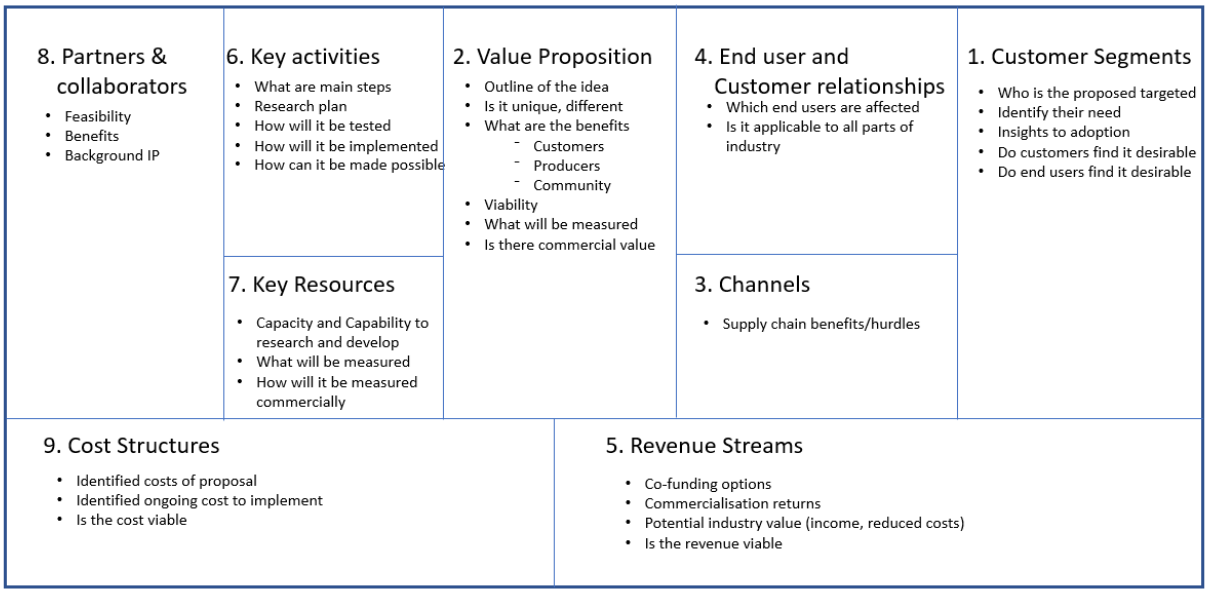


Figure 5 A modification of the Business Model Canvas (Osterwalder and Pigneur; 2010) and Lean Canvas templates (Maurya, 2012) proposed for APL Horizon concepts to satisfy Desirability, Feasibility and Viability attributes. Numbers represent relative importance of the Business Model Canvas that needs to be addressed.

After review and prioritisation, the APL Innovation progresses to Program Planning for timetabling, financial resourcing and identification of potential research or prototype providers. This is where a traditional research approach can differ to an adopted business model approach, where an innovative product or technical solution underpins the innovative concept. Where there is a need for the Innovation Plan to come up with a change in process, or a combination of technology advance and process change, the APL R&I team and the R&I GM will develop a Program Plan that will:

1. Identify broad milestones for action delivery
2. Identify budgets
3. Communicate and engage with stakeholders
4. Develop small scale prototypes or concept ideas with end users and customers

The final stage of the Development phase is to initiate the Research and Development stage. This will be undertaken by the APL R&I Team and will involve:

1. Liason between potential research providers, technology providers and end users;
2. Planning, invitation of research proposal submission, arranging expert review of proposals;
3. Recommending proposals to the APL Investment Committee where appropriate, or informing the IC of successful providers;
4. Managing the execution of contracts with successful participants;
5. Managing research projects with the Principle Researcher and communicate progress to industry.

As there will not be a set date to submit research proposals, researchers will need to be flexible in how and when they become engaged with APLs Innovation Plan. Keeping continually engaged with the APL R&I Team will be important as this approach is progressed. As previously mentioned, researchers will be given opportunity to be involved during the Discovery and Ideation phase and

into the Development phase. Whilst this involvement will be invited, it does not guarantee that a submitted research proposal from a participant during the concept development will be successful. As part of its responsibility to producer members, APL will be identifying the most suitable providers to address industry needs and knowledge gaps.

3. Validation

As the innovation concept progresses through the Development phase in Figure 3b, there will be a decrease in the level of uncertainty and increase in confidence that the project will deliver desired outcomes. Part of the transition between the Development phase and Validation phase should be included in the research project as a milestone. Where several research projects or experiments will combine to produce the solution, the Innovation Plan requires a commercial test or demonstration trial to confirm expected outcomes of the solution. In an Innovation Plan where a new piece of technology is produced, then testing of a prototype or bespoke piece of equipment would form part of the Validation. In the case of a new strategy or process, there needs to be a commercial testing step as part of the Research and Development program. This could be performed at an APL supported base funded Commercial Research facility and then tested on a Benchmarked Early Adopter facility, or Focus Farms, and change-monitored over time. Validation phases allow for modification of the concept/solution based on recordable feedback. This phase could use the descriptor of alpha and beta testing milestones, with alpha testing expected to be changed considerably following data capture of performance and productivity outcomes for example, whilst beta testing would incorporate real-world field testing and end user feedback as to how implementation can be improved. Validation phase is complete when the testing of the concept has reached a point where only small changes to the innovation is required before wide commercial implementation.

In the recent review of a decade of Research Final Reports (Nov 2020), it was highlighted that several funded research projects did not produce practical producer solutions that were ready for adoption at the end of research project. This may be due to further research being required to fully elucidate the research findings, however it highlights that some funded projects in the past have not fully delivered industry outcomes, or they have delivered only the research findings but not considered the commercial implementation. The Validation phase will be an essential part of the Research and Development program within the Innovation Plan.

4. Rollout and adoption

The final phase of the Innovation Plan is the implementation phase in industry. This occurs after the Research and Development program has ended and relies on an Extension and Adoption Program. It will likely include a Communications program to inform not only industry end users, but also Customers and other Industry Stakeholders.

The use of Focus Farms and the extension strategy will be managed by APL. As part of the Industry Capacity and Capability Plan, the use of Benchmarked farm properties with the help of Base Funded technical staff will provide measurement and monitoring capability in industry for widespread adoption. The MERI principle of Monitor, Evaluate, Review and Improve will allow the full investment value in the Concept and Research Program to be realized. The final stages of the Innovation Plan are for Optimisation. This allows a complete review of the whole concept and how effective it has delivered the Strategic Intent objective. This optimisation may result in new innovation concepts emerging and hence the Discovery stage is once again initiated.

5. Proposal Submission Process

Research project investment will be through a combination of strategic Horizon Programs and APL Solutions projects (Figure 6). The process of project submission has changed to increase flexibility. At any time, possible Solutions projects are identified by Reference Working Groups who represent industry and technical expertise (eg. ASF Industry Technical Panel; Eating Quality Technical Reference Group; Australian Pig Vets.) and/or APL Research Program Managers). Unless a specific group is identified to submit a proposal, an invitation for a *Request for Proposal.* The Principle Investigator is asked to discuss the proposal with the relevant APL Research Program director and GM R&I. If an idea is floated that has scientific merit; has not been done before; and meets industry outcome priorities the PI is encouraged to collaborate with others in the industry and importantly outside of the industry with appropriate technical knowledge. The PI will then prepare a project submission in APL's computer resource management (CRM) database. Budgets will be initially defined by AOP portfolio allocations.

Each proposal will be reviewed by APL Management and external reviewers. In the past, a selection of external reviewers was chosen as the Specialised Groups (SG). With the dis-continuation of SG's, the selection of external reviewers is by agreement between the APL Research Program Director and the GM R&I and will ideally choose four external referees (but may be limited to less depending on Conflict of Interest (COI) and availability) who are regarded as technical experts in the proposed field. Referees must also have no COI. Applications are being currently reviewed for:

- Significance (National or local)
- Track record of PI
- Likelihood of stated project objectives being met
- Value for investment money
- Adoption rate expected

In the future the CRM will be amended to include the same review questions as used by APRIL and be given a point score.

Figure 6. Schematic of differences between Solutions and Horizons projects.

6. How Portfolio Decisions are made - APL's Investment Committee

The Investment Committee oversees RDE investments portfolios, including those relating to:

- Ensuring industry priorities align with the Commonwealth's National Research Priorities and Rural Research & Development priorities (see *Purpose*, above);
- The implementation of Solutions and Horizons investments and setting targets for the relative spending within each sector;
- Critically evaluating the portfolio for each Horizon stream to ensure a recommendation can be provided to the APL Board to support the business plan and approve the allocation or requisition of resources;
- Evaluating the performance of APL's investment model annually, in terms of the alignment with APL's Strategic Plan and progress towards milestones, budget adherence, key deliverables, and investment value (with appropriate safeguards for commercially sensitive information) and report these to the APL Board; and,
- Being responsive to specific Board directives and provide feedback to APL Management for use in strategy development.

7. APL and APRIL

APL is the major investing member into the Australasian Pork Research and Innovation Ltd (APRIL), which succeeds the two successful Pork CRCs. APL has Board representation on APRIL and the GM R&I is a committee member of the R&D Advisory Committee (RDAC) which reviews proposal submissions. The GM R&I and the CEO of APRIL collaboratively work on research priorities and proposal priorities to minimize duplication of research funding concepts between the two companies.

The APL Investment Committee recommends Portfolios for funding. Elected Delegates representing Australian pork producers communicate contemporary pork production priorities to APL at least once per annum, which acts to inform the consideration of potential projects. If portfolios or major projects (beyond CEO delegation or involving the commitment of levies for future financial years) are supported by the Investment Committee, they are recommended to the Board.

APPENDIX II

Current and proposed Research project areas and outcomes for Reducing COP (Strategic Intent)

(i) Improved Herd Health Tactics Plan – 2020-25

Research Project	Collaboration	Adoption Method	Measure	Outcome
Horizons Early disease detection and surveillance - Genics Multipath - Single shot vaccine technology	Background IP In-kind project staff International collaboration and labs Commercial pharmaceuticals, autogenous vaccine suppliers, Dept of Ag, Swinburne Uni vaccinology	On-farm science-based testing	Decrease in animal disease Decrease in average cost (caused by less disease) Demonstrable extension of immunity	▪ Affordable routine early warning disease detection ▪ Lower COP through fewer losses and higher productivity ▪ Pen side PCR testing to speed up diagnosis ▪ Potential for exotic disease surveillance
Solutions Reducing pathogen load in piggeries - Ventilation and best-practice cleaning procedures - Longer lasting sanitizers - New generation disinfectants, foaming agents	Commercial providers Venture capital partnership	Focus farm for demonstration Fact sheets and on-line training videos as part of LMS Commercial R&I trials Creates a business of value to producers	Decrease in animal disease Decrease in average cost (caused by less disease) Cost-effective service adoption Business profitability Low residual bacterial and viral testing of surfaces Pig performance and mortality	▪ Lower disease challenge in piggeries ▪ Lower mortality and higher productivity ▪ Lower GHG emissions and odour ▪ Reduced COP through lower labour costs

(ii) Reduction in Feed Costs Tactics Plan – 2021-25

Research Project (options)	Collaboration	Adoption Method	Measure	Outcome
Horizons Lower diet costs - The validation of AUSCAN NIR technology for food waste sources - Reducing moisture content in food waste streams to <10% - Relaxing importation protocols of feed grains/ingredient through effective biosecurity controls Improved FCR - Genome modulation of FCR - Accelerated genetic gain technologies - Marker-less individual pig recognition and identification	APRIL Fight Food Waste CRC Waste 4 Profits Feedmillers, agric waste streams, Dairy industry, CSIRO, Fight Food Waste CRC AIA (collaboration with MLA, Chicken Meat, Aquiculture, Dairy, Eggs RDC's) Gene biotechnology Commercial genetic and equipment providers MLA, Uni NSW, international collaboration	Genetic suppliers Accelerated genetic uptake program On-farm demonstration Commercialisation via APRIL for affordable equipment supply Form and function demonstrations in feed mills Regulatory	Accuracy and batch variability Faster genetic uptake, Benchmarking Diversity of ingredients in least cost formulations Ingredient inclusion rates in diets year on year Measures of accuracy on farm	▪ Lower diet costs c/MJ DE ▪ Lower FCR both phenotypic and genetic trends ▪ More diverse ingredient supply ▪ Improved growth and carcass quality and uniformity ▪ Individual or pen based feeding delivery systems
Solutions Incorporation of in-line AUSCAN technology for liquid by-products Reduced feed wastage through in-line effluent monitoring Equipment capability demonstration of precision feeding Water quality and supply quantification on FCR	APRIL QDAF Equipment suppliers and international designers APRIL	Drying technology for wide range of ingredients On Farm demonstration Base Funding supported research projects	Number of units sold Number of units sold Cost comparison of precision feeding technology Carcass weight uniformity	▪ More accurate feed formulation, lower costs ▪ Reduced feed wastage ▪ Demonstrated ROI ▪ Improved carcass quality and delivery within specifications

(iii) Improved Productivity through WPS

Idea Source	Research Project	Adoption Method	Adoption Rationale	Measure
Research Network Science reviews Gene biotechnology Changes to Legislation	Sow productivity - Identified fecundity genes - Accelerated genetic gain Lean Meat Yield - Total leanness vs P2 leanness	On-farm science-based testing Improved selection for gilt replacement Adoption of low volume/high EBV semen	Reduces cost from scientific paper reporting Faster genetic uptake Higher generational improvement	WPSY of 26 by 2025 in Benchmark herds Lower COP by 50c/kg relative to 2020
Business Innovation	Gene biotechnology		Investment into labs and companies that sell gene identification, editing capability	

APPENDIX III

Current and proposed Research project areas and outcomes for Quality Pork Eating Experience (Strategic Intent)

Research Project	Collaboration	Adoption Method	Measure	Outcome
Horizons				
Processing monitoring and benchmarking of carcass quality - Carcass pH audits	Export processors, PPRG	6 monthly audit reporting, quantification of carcass pH variation	Benchmarked pH change % of carcasses within ideal pH range	▪ Less quality variation Retailers increase value/preference for pork produced through quality standards
Quality eating experience systems - Validation of PQS score system with consumers - Development of quality standards requirements along the supply chain	Sensory analytical services, MDC, Retaillers	Data sharing Small pilot study	Annual *Insight* failure rates	▪ Higher demand for pork ▪ Preferred supply of Australian pork primals for ham and bacon by manufacturers
Improving pork eating quality on farm - Genetic solutions to increase IMF, water holding capacity - Nutritional solutions to desirable pork flavour - Avoiding the metabolic disorders contributing to poor meat quality	Research providers, overseas genetics collaborators	Technical reports, genetic supply chain, nutritionists		
Differentiating Australlian ham and bacon based on quality	Small good manufacturers, retailers, consumers	More direct engagement with ham and bacon manufacturers Economic cost modelling of quality benefits		
Solutions				
- Measuring range in IMF within and between supply chains - Rapid measurement of IMF - Eliminating boar taint through correct Improvac protocols	Commercial providers Base funders	Focus farm for demonstration Fact sheets and on-line training videos as part of LMS Commercial R&I trials	Benchmark auditing of boar tain levels in Improvacs across supoly chains Annual *Insight* failure rates	▪ Better tasting pork ▪ Lower failure rates

APPENDIX IV

Current and proposed Research project areas and outcomes for Biosecurity Leadership (Strategic Intent)

Research Project	Collaboration	Adoption Method	Measure	Outcome
Horizons Data driven biosecurity - Exoflare ap development and commercialisation Preparing for ASF - DDD stage 1 and 2 - Truck wash stage 1,2 and 3 - ASF Technical Panel support Increasing capacity of EAD Surveillence through PCR	Exoflare Vets, herd health consultants, overseas insights AHC and DAWE Biosecurity, Genics	On-farm science-based testing Fact sheets and on-line training videos (Mintrac) as part of LMS Input into AHA AUSVETPLAN Manual writing	No exotic disease outbreaks All AUSVETLAN manuals up to date Training material resources on website and extended to producers	▪ Continued pig supply ▪ Pen side PCR testing for exotic diseases to miniimise response time ▪ High level of confidence in pig industry preparedness and responsibility ▪ Business insurance
Solutions ASF Preparedness - Composting study and demonstration - Extension activities	Commercial providers	Focus farm for demonstration Fact sheets and on-line training videos as part of LMS	Decrease in endemic animal disease Cost-effective service adoption	▪ Lower disease challenge in piggeries ▪ Lower mortality and higher productivity Decrease in average cost (caused by less disease) Business profitability

APPENDIX V

Current and proposed Research project areas and outcomes for Climate Friendly Farming (Strategic Intent)

Research Project	Collaboration	Adoption Method	Measure	Outcome
Horizons Benchmarking LCA's	External providers by tender	Benchmark reporting and continual improvement	Against measures	Demonstrable change over time
Solutions - Road map review for research and policy direction in carbon positive and zero waste - Better use of existing environmental models - Completion of waste stream utillisation	Commercial consultants Commercial software consultants Waste for Profit grant, DAWE Fight Food Waste CRC	Focus farm for demonstration	TBC	Methods of benchmarking measurement established Opportunities for diverse income streams with carbon credit investmenrt