Strategic review of extension and adoption in the wine sector: Final report

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Wine Australia

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EXECUTIVE SUMMARY

One of the recommendations of the 2019 independent performance review of Wine Australia was that the organisation 'review the way it manages extension and adoption of R&D outcomes and to consider whether a more structured approach is required'.

This report presents the findings of this review. The review involved a six-stage process with some of the stages undertaken concurrently. It looked at contemporary theories in extension, behaviour change and related disciplines, and examined how wine and other agriculture sectors in Australia are applying these. An extensive review of relevant plans, reports and survey findings was undertaken as well as comprehensive industry consultation of both service providers and sector practitioners (recipients). The findings from these analyses are applied and recommendations provided to Wine Australia to adjust its current approach with a sector strategy for extension and adoption proposed.

It is noteworthy that other agricultural sectors examined during the course of this review are also applying contemporary theories in extension and adoption and are investing more directly in extension and adoption programs, especially at a regional level.

The combination of document review, various survey outputs and widespread industry consultation led to the following general observations about extension and adoption in the wine sector:

- There are many people striving to improve the industry and passionate about their role in it;
- Extension and adoption are certainly not 'broken' in the wine and winegrape sector, and functions no better / no worse than several other industries with which we have been involved;
- There are some excellent extension and adoption activities available;
- There are other areas that could be improved;
- If anything, there has been too great a focus on outputs rather than outcomes and impacts, and this should change;
- Contemporary extension and adoption thinking involves participants in determining the priorities and extension and adoption activities. This could be enhanced in the sector; and
- Wherever possible:
  - Create a promise for participants, and honour that promise;
  - Provide an array of extension and adoption approaches to suit differing learning preferences. That said, use of electronic means (webinars, podcasts) should be increased;
  - Use case study examples showing the clear costs and benefits; and
  - Focus on 'learning by doing / showing', rather than 'learning by saying'.

The following recommendations were made for Wine Australia's consideration:

Strategy

1. Every extension and adoption activity that Wine Australia supports should reflect contemporary best-practice principles from extension, design thinking, social marketing and related disciplines, as summarised in this report. These principles should be clearly enunciated in the extension and adoption strategy and used as guiding principles which all activities should meet.

2. Wine Australia should consider the development of a 'single-source of truth' in relation to viticultural and oenological practices. This could take the form of a web-based best practice manual. Such a manual should be updated with the latest research results as they become available. It is acknowledged that much of this is already available from existing resources (e.g. AWRI, Wine Australia, NSW DPI, PIRSA etc). The aim will be to provide a seamless integrated resource (not necessarily hosted by one organisation) for use by practitioners and advisors.
3. Early engagement of levy-payers (extension and adoption target markets) is crucial. In this regard, Wine Australia should establish a levy-payer based advisory committee to assist AWRI and Wine Australia to identify extension and adoption priorities and plan activities at a national level. The charter of the Australian Grape & Wine Research Advisory Committee could be expanded for this function.

Resources

4. Whilst recognising Wine Australia's restricted budget situation, any additional allocation of resources should be targeted at extension and adoption activities rather than a greater allocation to R&D. In particular, additional resources to the regional program is seen as a priority.

AWRI

5. AWRI should remain an important extension and adoption conduit to the grape and wine sector.
6. The relationship between Wine Australia and AWRI from an extension and adoption perspective needs to be nurtured and be based on mutual trust and understanding. It should operate on a policy of 'no surprises'.
7. In undertaking its activities, AWRI should increasingly engage with other research and extension providers in joint delivery.
8. Key performance indicators (KPIs) in the AWRI and Wine Australia annual operational plans are very output-focused. In future, KPIs should be a combination of outputs and outcomes (SMART objectives – specific, measurable, achievable, realistic and timely). This will also require adjustment to monitoring and evaluation procedures to appropriately capture outcomes.
9. The scope of AWRI's extension and adoption activities should include the following:
    - 9.1 The design and delivery of extension programs, however:
        - 9.1.1 The process for activity topic selection and delivery design is inclusive and involves AWRI, Wine Australia, regional associations and other user groups.
        - 9.1.2 Activities should be demonstrably designed using best practice principles as outlined in the extension and adoption strategy, according to the nature of the topic, the target audience and other relevant factors. In particular, there should be a stronger emphasis on hands-on learning activities and less on 'stand and deliver' formats such as seminars.
        - 9.1.3 All activities should provide prospective participants with a clear 'promise' that attendance will afford them the ability to implement a particular beneficial practice.
        - 9.1.4 Seminars are important but should be arranged to maximise time efficiency of presenters and the audience. A strong focus should be given to identifying and utilising more modern formats that offer cost-efficiency and convenience such as webinars or podcasts. Opportunities to adopt such formats should be identified in collaboration with the target audience.

9.1.5 There should be a more even balance between winemaking and viticultural topics (an expected outcome of 9.1.1).

9.1.6 The definition of seminars and workshops should be refined and, potentially, the term 'roadshow' should be removed as it is used to refer to other activities in which Wine Australia is involved.

9.1.7 Participation in Wine Australia marketing events should form a separate activity and reported separately to enhance transparency.

9.2 Communication with stakeholders:

9.2.1 This should be focused entirely on extension and adoption activities. Other, 'non-extension' communication activities that are considered important should be redirected into other components of the AWRI–Wine Australia existing plan and renegotiated for the next planning period. For example, the AWRI Annual Report should not be considered an extension tool.

9.3 AWRI help desk:

9.3.1 The help desk is a service that is valued by the grape and wine sector. No changes are proposed, although greater transparency in the allocation of funds between technical winemaking trials and the use of help desk queries to assist with workshop topic selection, particularly for the regions, is required.

9.4 Library services:

9.4.1 There should be a sharp focus on transforming the library into a modern knowledge hub that searches, sources and curates the latest national and international information into readily-accessible packages for use by the sector. The library is expected to be a principal source of content for the 'single-source of truth' as described in the extension and adoption strategy.

9.5 Regional Program:

9.5.1 As AWRI is or could potentially be a provider of services to the Regional Program, good governance principles require that the program coordinator role be subsumed back into Wine Australia's responsibilities.

10. AWRI should undertake a regular survey to assess the impact of its extension and adoption activities. Such a survey should be undertaken in collaboration with Wine Australia and should cover AWRI session participants and those who have not participated in such events. The focus should be on what practice change has been applied and what factors contributed to adoption, to obtain indicative attribution. The survey should be designed and conducted in close consultation with Wine Australia to ensure it does not duplicate other similar surveys and to maximise its value.

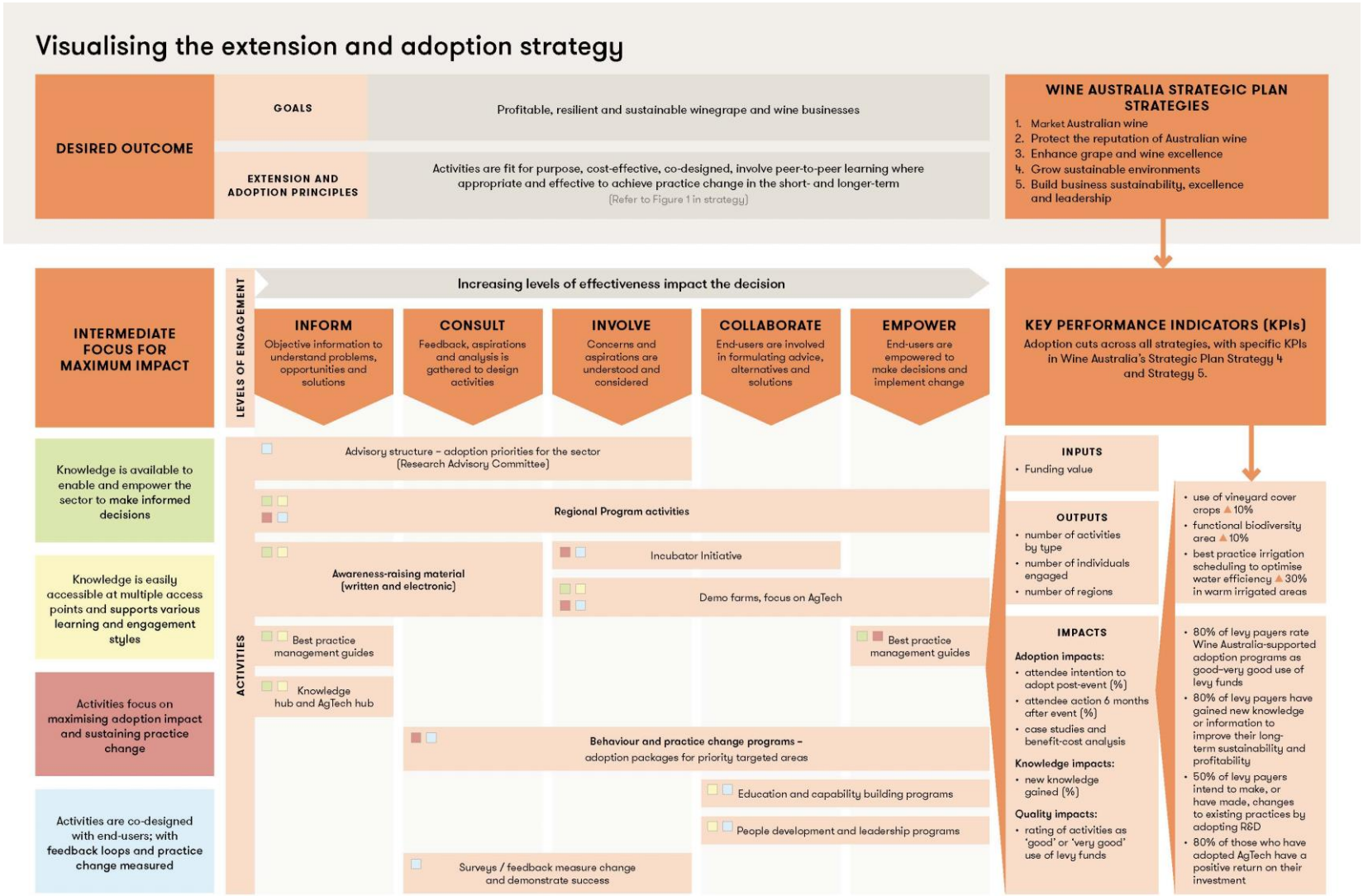
Regions

11. The Regional Program should continue to be supported by Wine Australia. To deliver greater benefits, additional planning resources should be made available to those regions that would benefit from them (either via Wine Australia or from other regions).

12. An annual, one-day meeting at Wine Australia should be made available for regions to gain a full briefing on Wine Australia R&D and marketing activities (potentially using a 'speed dating' format) and to share experiences. The same or a similar event should be made available to sector consultants.

13. Wine Australia should redevelop the regional project template to encourage SMART objectives and clear but simple communication activities and enhanced monitoring and evaluation outcomes of each activity. Such changes should simplify, not complicate, its completion.
14. The recommendations in the AgThentic report are supported by this review. The scope of their implementation will impact on this report. In particular, consideration should be given to supporting AgThentic's recommendations regarding:
    a. The appointment of a Community Technology Manager.
    b. The establishment of a focus vineyard(s) in a regional location(s) to bring together selected technologies (AgTech), solving pertinent local challenges. Activities in central SA, northern SA, Queensland and Loxton to name some, are good examples.
    c. The development of a database of existing technologies (see also Recommendation 2).
15. Wine Australia should develop processes whereby the results of the regional program projects can be better shared across the network. This could be via a dedicated web-page, supplemented by half-yearly teleconferences between regional leaders, AWRI and Wine Australia staff to share experiences (or some sort of online or smartphone sharing platform).
16. The Incubator Initiative should continue. Wherever possible, ease of access should be a consideration.

Based on these recommendations, an extension and adoption strategy was developed and has been provided as a separate document. The general structure of the strategy is shown pictorially below.


Visualising the extension and adoption strategy
DESIRED OUTCOME
GOALS
Profitable, resilient and sustainable winegrape and wine businesses
EXTENSION AND ADOPTION PRINCIPLES
Activities are fit for purpose, cost-effective, co-designed, involve peer-to-peer learning where appropriate and effective to achieve practice change in the short- and longer-term
(Refer to Figure 1 in strategy)
WINE AUSTRALIA STRATEGIC PLAN STRATEGIES
1. Market Australian wine
2. Protect the reputation of Australian wine
3. Enhance grape and wine excellence
4. Grow sustainable environments
5. Build business sustainability, excellence and leadership
INTERMEDIATE FOCUS FOR MAXIMUM IMPACT
Knowledge is available to enable and empower the sector to make informed decisions
Knowledge is easily accessible at multiple access points and supports various learning and engagement styles
Activities focus on maximising adoption impact and sustaining practice change
Activities are co-designed with end-users; with feedback loops and practice change measured
LEVELS OF ENGAGEMENT
Increasing levels of effectiveness impact the decision
INFORM
Objective information to understand problems, opportunities and solutions
CONSULT
Feedback, aspirations and analysis is gathered to design activities
INVOLVE
Concerns and aspirations are understood and considered
COLLABORATE
End-users are involved in formulating advice, alternatives and solutions
EMPOWER
End-users are empowered to make decisions and implement change
ACTIVITIES
Advisory structure – adoption priorities for the sector (Research Advisory Committee)
Regional Program activities
Awareness-raising material (written and electronic)
Incubator Initiative
Demo farms, focus on AgTech
Best practice management guides
Best practice management guides
Knowledge hub and AgTech hub
Behaviour and practice change programs – adoption packages for priority targeted areas
Education and capability building programs
People development and leadership programs
Surveys / feedback measure change and demonstrate success
KEY PERFORMANCE INDICATORS (KPIs)
Adoption cuts across all strategies, with specific KPIs in Wine Australia's Strategic Plan Strategy 4 and Strategy 5.
INPUTS
• Funding value
OUTPUTS
• number of activities by type
• number of individuals engaged
• number of regions
IMPACTS
Adoption impacts:
• attendee intention to adopt post-event (%)
• attendee action 6 months after event (%)
• case studies and benefit-cost analysis
Knowledge impacts:
• new knowledge gained (%)
Quality impacts:
• rating of activities as 'good' or 'very good' use of levy funds
• use of vineyard cover crops ▲10%
• functional biodiversity area ▲10%
• best practice irrigation scheduling to optimise water efficiency ▲30% in warm irrigated areas
• 80% of levy payers rate Wine Australia-supported adoption programs as good–very good use of levy funds
• 80% of levy payers have gained new knowledge or information to improve their long-term sustainability and profitability
• 50% of levy payers intend to make, or have made, changes to existing practices by adopting R&D
• 80% of those who have adopted AgTech have a positive return on their investment

ACRONYMS

AHDB	Agriculture and Horticulture Development Board (UK)
AOP	Annual operating plan
ASVO	Australian Society of Viticulture and Oenology
AWITC	Australian Wine Industry Technical Conference
AWRI	Australian Wine Research Institute
BGWA	Barossa Grape and Wine Association
CBSM	Community-based social marketing
CRDC	Cotton Research and Development Corporation
CRRDC	Council of Rural Research and Development Corporations
CSD	Cotton Seed Distributors
CVCB	Cooperative Venture for Capacity Building
CVWGA	Clare Valley Wine and Grape Association
DA	Dairy Australia
FOB	Free-on-board
GWRDC	Grape and Wine Research and Development Corporation
IAAC	Industry Adoption Advisory Committee (of SRA)
KPI	Key performance indicator
MLA	Meat & Livestock Australia
NPS	Net promoter score
RDC	(Rural) Research and development corporation
RD&E	Research, development and extension
RDP	Regional Development Program (of DA)
SARDI	South Australian Research and Development Institute
SMART	Specific, measurable, achievable, realistic and timely
SRA	Sugar Research Australia

1. BACKGROUND

One of the recommendations of the 2019 independent performance review of Wine Australia was that the organisation 'review the way it manages extension and adoption of R&D outcomes and to consider whether a more structured approach is required'.

The optimal adoption of R&D outcomes by stakeholders (producers, intermediaries such as farm consultants and others) is critical to the success of every agricultural sector, because the benefits of that R&D do not accrue until it is used in practice. Furthermore, it is increasingly recognised that extension and other means to drive adoption are a critical part of the innovation cycle, because the application of new practices or technologies should inform the next wave of innovation.

For research & development corporations (RDCs), adoption is a continuous challenge. It is notable that several RDCs have recently developed new strategies for extension and adoption. The importance of adoption has recently been emphasised in the background paper to the Minister for Agriculture's review of the RDC system.

This report presents the findings of a review of extension and adoption in the Australian grape and wine sector. It also looks at contemporary theories in extension, behaviour change and related disciplines, and examines how wine and other agriculture sectors in Australia and overseas are applying these. The findings from these analyses are applied to develop recommendations to Wine Australia to adjust its current approach, and a sector strategy for extension and adoption is proposed.

2. APPROACH

This review involved a six-stage process as outlined below. Some of the stages were undertaken concurrently.

Stage 1: Inception meeting

An initial inception meeting was held with Wine Australia staff in Adelaide in April 2019 to discuss and agree a range of issues relevant to the project including:

- Confirmation of project objectives and timings;
- Input requirements (including access to documentation, personnel, agreement on stakeholders to be interviewed);
- Sensitivities in regard to the review; and
- Finalisation of timeframes and scheduling of regular progress update meetings.

Stage 2: Literature review

An environmental scan and review of contemporary literature of extension and adoption in both the wine sector and agriculture more generally was undertaken concurrently with initial interviews. This was not an expansive review of all literature but one best suited to the scope of this project. Importantly, it identified and discussed contemporary thinking in this area (e.g. design thinking, commercial marketing, social marketing) that could form part of the suggested approach. The literature reviewed is listed in Appendix 1.

Stage 3: Sector communication and survey

It was intended to develop a short online survey (using Survey Monkey®) that would provide a means by which any member of the sector might provide their views on current wine sector extension / adoption approaches, plus opportunities to have input on their preferred approach (if different to existing approaches). Ultimately this was not progressed, because:

- AWRI, at short notice, commissioned an 'evaluation of current extension activities' by First Person Consulting entitled 'AWRI Practice Change Evaluation' (see 4.1.1). The evaluation 'sought to understand the appropriateness and effectiveness of extension services and events and provide suggestions and recommendations for ongoing delivery of extension activities'. It surveyed people who had used or accessed AWRI extension services or attended extension events in the last two years.
- Wine Australia commissioned stakeholder research by Intuitive Solutions (Wine Australia stakeholder research, August 2019, Interim report).
- Wine Australia also commissioned a Grape and Wine Practice Survey in 2019 by J&R Coutts.

As a result, a further survey specifically for the purposes of this review was seen to be inappropriate at the time.

However, a short communique on the project was prepared inviting participation / submissions to the consultants.

Stage 4: Information collation and sector consultation

This stage involved two integrated activities:

1. Information collation – a review of current wine extension / adoption plans and projects, including interviews with Wine Australia staff associated with these projects. The documents reviewed are listed in Appendix 1.
2. Sector consultation. This involved four distinct components:
    a. Several meetings with AWRI staff;
    b. Attendance at the Australian Wine Industry Technical Conference (AWITC) in July;
    c. Inclusion of extension / adoption discussion during sector workshops while developing (concurrently) a 30-year vision for the sector (which involved 8 workshops pan-Australia); and
    d. Interviews (face to face or via teleconference) with other extension providers and with sector personnel (wine makers and viticulturists). Wine Australia staff provided a listing of people to contact in this regard.

Around 30 direct consultations were undertaken over the course of the review, additional to the workshops.

Stage 5: Draft report and presentation to management

Drawing together all of the information obtained from stages 2 to 4, this draft report and associated strategy were prepared. The draft report and draft strategy were discussed at the Wine Australia RD&E Committee meeting of early February 2020. The committee was largely supportive of the review and recommendations. Further discussions between Wine Australia staff and the authors identified final changes to enable the development of the final report.

Stage 6: Final report

This final report was completed and submitted to Wine Australia.

3. LITERATURE REVIEW AND ENVIRONMENTAL SCAN

[Note: This section is intended to provide an overview of contemporary theory of agricultural extension and adoption, and of other related developments. It is **not** a comprehensive literature review, as such reviews have been completed in recent years and there is little to be gained from reinventing the wheel.]

3.1 DEFINITIONS

Multiple definitions for 'agricultural extension' are to be found in the literature. Coutts J&R (2017) define it as 'the process of encouraging and supporting voluntary *change* [our italics] on farm to improve production, profitability, environmental and/or social outcomes'. Speaking in the context of practice change to benefit Great Barrier Reef catchments, they note that extension is one of a suite of approaches to encourage and support change, others including grants and incentive funding, legislation and regulation, price incentives and industry policies and guidelines.

'Change' in relation to practice might be considered to equate to 'adoption'; and 'adoption' (of a new technology or practice) often appears to be a preferred term to 'extension', implying as it does an outcome rather than a *means* to an outcome. However, the term 'adoption' is itself somewhat problematic, as 'non-adoption' may be a successful outcome of extension where a rational decision is made not to adopt (McGuckian & Flanagan-Smith 2013).

Perhaps for this reason, Coutts & Roberts (2003) have preferred to describe the outcome of extension as 'capacity building in individuals and communities'. The term 'capacity building' is more consistent with the growing understanding that innovation in agriculture (and indeed generally) is not a linear process of the form described by Rogers (1983, cited in Nettle 2013) and others (see below).

It is interesting that no clear, preferred terminology appears to have been settled upon for the activities that take place beyond the 'R&D' phase of innovation, to the extent that that phase can clearly be delineated. (If it is genuinely accepted that the innovation process is much more circular and iterative than linear – as described in design thinking, for example (see below) – then the various phases of the innovation process become quite blurred.) Sugar Research Australia, for example, uses 'adoption' as the overarching term in its recent strategy. Horticulture Innovation Australia has recently created an 'Extension & Adoption' function within its organisational structure. Cotton Research & Development Corporation uses 'extension' (see below).

3.2 THEORETICAL FRAMEWORK

3.2.1 AGRICULTURAL EXTENSION AND ASSOCIATED DISCIPLINES

According to Nettle (2013), the linear or 'transfer of technology' model of the relationship between science, technology and the community 'has been the defining paradigm of agricultural RD&E during the industrial era'. The linear model comprises six steps: needs/problems, research, development, commercialisation, diffusion and adoption, and consequences. At its core are three practice groups: researchers, extension practitioners and farmers.

The model has been extensively criticised and numerous problems identified in relation to it. Among these are the implication that scientists lead and drive the model, and its inadequacy in respect to 'complexity, uncertainty

and plurality within the knowledge system', including the multiple actors that play important roles in farm decision-making. This is not to say that the technology transfer model is wrong, rather that it is too narrow in its conception and best suited to relatively straightforward technologies.

Between 2001 and 2007, the Rural Industries Research & Development Corporation (RIRDC, now AgriFutures Australia) hosted a joint investment between several rural Research & Development Corporations (RDCs) and government agencies, known as the Cooperative Venture for Capacity Building (CVCB). The CVCB 'invested in research and development projects focused on enhancing the understanding of learning, improving organisational arrangements to support rural human capacity building, and inspiring innovative farming practices' (Hassall & Associates 2008).

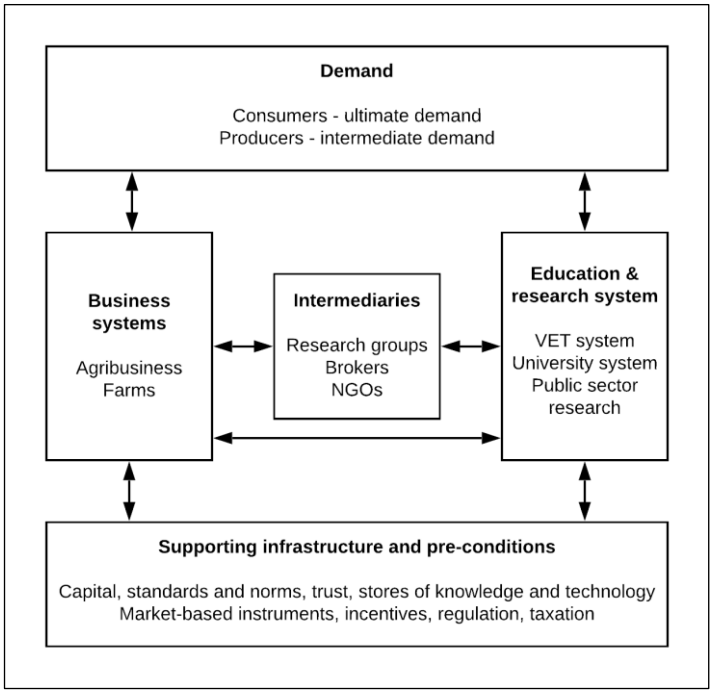
A significant corpus of literature and understanding resulted from the CVCB and continues to influence approaches to capacity building. The best-practice features of various modes of capacity building identified through the CVCB are discussed below.

More contemporary thinking on extension / capacity building in agriculture appears to be taking a more holistic perspective on innovation. Arnold & Bell (2001, cited in Nettle 2013) argue that 'the process of working with and adapting existing knowledge is the primary activity of innovation, not the transfer of supposedly new knowledge and information'. This is a critical insight, because it acknowledges the multiple points of origin of innovations in the system, not just in research.

Their representation of a national innovation system for Denmark is shown in Figure 1. The model seems as appropriate for Australia as it does for Denmark. As Nettle (2013) notes, the model highlights that:

- Farmers and service providers are not only end-users of agricultural RD&E, they are also producers;
- RD&E can be positioned at multiple points in the system; and
- The system is underpinned by a range of factors that are outside the control of any individual participant or group.

Figure 1: Representation of a national innovation system for Denmark



Source: Arnold & Bell (2001), cited in Nettle (2013)

Terms such as 'innovation platform', 'innovation system' and even 'innovation ecosystem' are now being used more commonly in relation to agricultural R&D, especially in the context of developing countries (see for example Schut et al 2018). Innovation platforms are alliances or collaborations between multiple individuals, who often represent organisations and who bring different backgrounds, expertise and interests, to diagnose problems, identify solutions or opportunities and find ways to achieve their goals. They are most useful when a problem or opportunity has multiple stakeholders, a multiplicity of perspectives and approaches is required and there is a willingness to share knowledge, resources, benefits, and risks (Schut et al 2018).

An example of an innovation platform is the 'living lab'. According to Australian Living Labs Innovation Network,[1] living labs are 'user-centred, open innovation ecosystems based on a systematic user co-creation approach that integrates research and innovation processes in real life communities and settings'. Living labs are one of the bases of a project currently underway in the European Union, 'AgriLink 2020'. AgriLink is seeking to 'stimulate transitions towards more sustainable European agriculture by furthering the understanding of the roles played by a wide range of advisory organisations in farmer decision-making and enhancing their

[1] https://www.australianlivinglabs.com.au/about/

contribution to learning and innovation'.[2] The AgriLink website presents some interesting examples of living labs, such as one in Norway that aims to improve environmental outcomes through crop rotations.

A major project completed in 2018 in Australia has provided some useful insights into more collaborative modes of extension, specifically in relation to private sector involvement (University of Melbourne 2018). The project, 'Stimulating private sector extension in Australian agriculture to increase returns from R&D', was a collaboration between six RDCs, the Victorian and NSW governments and the University of Melbourne and was funded under the Federal Government's Rural R&D for Profit program.

The project comprised four action research trials, each involving a specific private sector adviser type. It identified a number of 'stimulating factors for cross-industry, private sector engagement', including the need to make the co-innovation 'fit for business', to acknowledge the commercial context in which private-sector collaborators operate (including competition) and to consider market signals for co-innovation.

Guidelines for government and RDCs for engaging the private advisory sector in agricultural RD&E, arising from the project, have been published (Paschen 2018).

3.2.2 RELATED INNOVATION AND CHANGE MANAGEMENT DISCIPLINES

A number of 'disciplines' that may offer insights into adoption of agricultural R&D have been canvassed by extension theorists and practitioners at various times. These are discussed below. The following is not intended to be an exhaustive listing of these bodies of thought, nor is any attempt made to develop a coherent typology of the various theories of innovation, change management or behavioural change. Rather, this section is intended to identify the common elements of various theories that have been discussed from time to time in Australian and international agriculture, and their implications for extension in the wine sector.

DESIGN THINKING

'Design thinking' has received considerable attention as a management approach in recent years (in fact in September 2015, it was the headline topic of the Harvard Business Review). According to Liedtka & Ogilvie (2011), design thinking is 'a systematic approach to problem solving'. It encourages managers to think more like designers, favouring prototypes, experimentation and iteration over analysis and planning.

Table 1 summarises the key differences between conventional ('MBA') thinking and design thinking.

[2] https://www.agrilink2020.eu/why-agrilink/

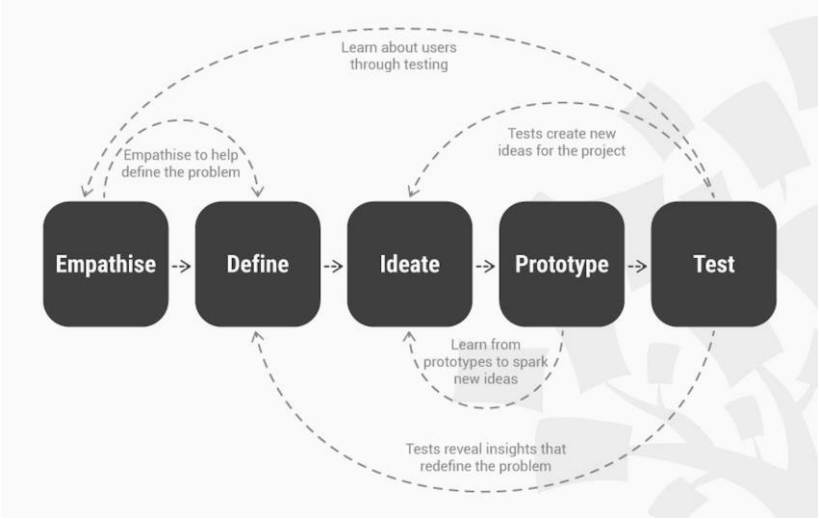
Table 1: Differences between conventional business thinking and design thinking

	BUSINESS	DESIGN
Underlying assumptions	Rationality, objectivity; Reality as fixed and quantifiable	Subjective experience; Reality as socially constructed
Method	Analysis aimed at providing one 'best' answer	Experimentation aimed at iterating toward a 'better' answer
Process	Planning	Doing
Decision drivers	Logic; Numeric models	Emotional insight; Experimental models
Values	Pursuit of control and stability; Discomfort with uncertainty	Pursuit of novelty; Dislike of status quo
Levels of focus	Abstract or particular	Iterative movement between abstract and particular

Source: Liedtka & Ogilvie (2011)

Liedtka & Ogilvie (2011) state that design thinking follows four phases, each answering a fundamental question: *What is?*; *What if?*; *What wows?*; and, *What works?* They list ten tools used to answer these questions, including brainstorming, rapid prototyping and customer co-creation. The non-linear nature of design thinking is an emphasised feature of the discipline (Figure 2).

Figure 2: Design thinking process



Source: Bucolo (2019)

Several of the RDCs, including Wine Australia, are considering the application of design thinking in their approach to innovation. Meat & Livestock Australia (MLA) is the most advanced in this respect and has identified specific applications of design thinking in its business processes. Beef and Lamb New Zealand has also utilised a design-thinking approach to the creation of a new market development strategy and action plan.[3]

Design thinking has clear appeal as a framework for agricultural innovation. The framework is coherent and its principles are entirely consistent with contemporary innovation or adoption theory, particularly the emphasis on genuinely understanding the perspective of the 'customer' (levy payer) We would argue that much of it is not particularly new, especially in respect to the non-linearity of innovation and the importance of co-creation, and there are examples of a form of design thinking (although not so named) being applied by RDCs at least a decade ago.[4] However, the rise in significance of AgTech – which lends itself to rapid design-trial-redesign iterations – as part of the agricultural innovation landscape suggests that design thinking has an increasingly useful role to play in the way RDCs operate.

COMMERCIAL MARKETING AND SOCIAL MARKETING

Pahl (2016) argues that there are three main approaches to changing behaviour: education, regulation and marketing. Education is the most commonly used tool but is often ineffective, as it tends to assume that the audience 'is already prone to expressing the behaviour and the benefits are easily appreciated and already align with the self-interest of the target audience' (p.10, citing Rothschild 1999). Regulation is often likewise ineffective, and inappropriate for many best management practices.

Marketing, which 'create(s) alternative choices in the target's environment that leads to voluntary self-interested exchange' (Pahl 2016, p.4), offers a more promising pathway to achieve behavioural change. It is appropriate in situations where the audience is ambivalent about the message but can be persuaded to change provided the benefit is well articulated.

Aspects of commercial marketing theory and practice have been applied to the adoption challenge by RDCs. Simplistically, linear models of extension at least can be seen as comparable to marketing exercises in which players who hold an innovation compete to 'sell' their product or practice to a buyer. For-profit marketing companies are sometimes in competition with independent innovation brokers such as RDCs, researchers or consultants, where research findings and marketing messages are in conflict – for example, where a crop or animal health company promotes a particular chemical that is not the best in its class.

Examples of the application of commercial marketing methodologies to adoption are the use of market research, to understand barriers and facilitators to adoption of an innovation, and segmentation of the target market. An example from the sheep and beef industries in New Zealand is provided by Brown & Bewsell (2010), who present a case study on the application of segmentation to an extension program on feed planning. Segmentation, targeting and positioning has also been used in Australia, for example by MLA in considering

[3] https://www.thinkplaceglobal.com/work/radical-cross-sector-collaboration-unites-red-meat-sector

[4] For example, Australian Wool Innovation was using skunkworks, rapid prototyping and other 'design thinking' tools to address mulesing and wool harvesting in the early 2000s.

the delivery of its adoption initiatives generally (Donnelly et al 2014). It is a useful approach to help identify where scarce resources should be deployed for greatest return.

Recent years have seen increased interest in 'social marketing', which 'seeks to develop and integrate marketing concepts with other approaches to influence behaviour that benefit individuals and communities for the greater social good'.[5] Essentially, social marketing takes elements of commercial marketing and many other disciplines (psychology, sociology, anthropology and communications theory) and applies them in a social good context (Pahl 2016).

A comprehensive review of social marketing, in the context of agricultural extension (specifically, the northern beef industry) was undertaken by Pahl (2016). Pahl concludes that social marketing is effective in changing voluntary behaviours, although he notes that its full implementation is intensive, time-consuming and costly. He describes 11 'benchmark criteria' that make up a framework of actions for a social marketing initiative:

1. **Challenge statement:** the general issue to be addressed and the people who are affected.
2. **Customer orientation:** collection and analysis of data to understand the target audience, especially its emotional engagement and barriers to change, building on the assumption that any misunderstanding or 'fault' lies with 'us', not the 'customers'. Projects should involve members of the audience and other stakeholders in the project design and oversight.
3. **Clear focus on behaviour:** establishment of 'SMART' (specific, measurable, achievable, realistic and timely) behavioural goals to allow monitoring and evaluation of progress. The selected behaviours should clearly relate to the challenge statement. Incremental behavioural changes ('early wins') should also be considered to provide motivation.
4. **Informed by behavioural theory:** project design using any of a range of theories, for example stages of change experienced by individuals (pre-contemplation, contemplation etc), characteristics of innovations (e.g. trialability, relative advantage).
5. **Audience insight:** development of 'actionable insights' (more than just data) – truths about the customer (behaviours, experiences, beliefs etc) that inform the development of interventions.
6. **Exchange:** emphasising the value to the user, the satisfaction of underlying motivations. The 'benefit' may relate to self-perception rather than a more objective positive benefit/cost analysis. Barriers to change identified in (2) need to be addressed.
7. **Competition:** awareness of and intervention design to address competing existing or alternative behaviours, minimise their appeal and position the desired behaviour positively in relation to these.
8. **Segmentation:** identification of sub-groups of the audience with common characteristics to allow the tailoring of interventions. These characteristics may be, for example, demographic, geographic, behavioural or psychographic.

[5] Consensus definition developed the Australian Association of Social Marketing, International Social Marketing Association and European Social Marketing Association; https://www.aasm.org.au/what-is-social-marketing/, accessed November 2019

9. **Mix of methods:** design of the 'offer', which can be conceived in terms of the '4 Ps' of traditional marketing:

- Product – the bundle of 'goods' or benefits – ideas, behaviours and tangible objects;
- Price – the bundle of 'bads' – financial, time, energy and 'psychic' costs (the latter being the mental cost of having to change an attitude or behaviour);
- Place – distribution channels, including mass media and intermediaries.
- Promotion – any communication that occurs between the originator of the program and the audience, including advertising, emails, newsletters and meetings. In an extension context, Pannell et al (2006) recommend multiple channels, repetition, multiple deliverers of the message and harnessing peer pressure to ensure different learning styles and preferences are satisfied and confidence is built.

  Other 'Ps' – partnerships, policy and purse-strings – have also been recommended for social marketing (Butler et al 2007, cited in Pahl 2016).

10. **Piloting:** subjecting of methods and tools to initial small-scale implementation, evaluation and refinement.
11. **Broad-scale implementation and evaluation:** systematic and rigorous evaluation to demonstrate the extent of their effectiveness and allow adjustment as required.

One variant of social marketing is community-based social marketing (CBSM), the origins of which lie in efforts to promote sustainable behaviours (such as recycling or healthier eating) in communities. CBSM is associated with Dr Doug McKenzie-Mohr, a former Professor of Psychology at St Thomas University in Canada, who created strong interest when he delivered CBSM workshops in Australia in 2019.

CBSM 'emphasises direct contact among community members and the removal of structural barriers'. It involves four steps:

1. Identifying the barriers to a behaviour;
2. Developing and piloting a program to overcome these barriers;
3. Implementing the program across a community; and
4. Evaluating the effectiveness of the program.

The program itself comprises a variety of 'tools of change' such as financial and non-financial incentives / disincentives and the recruitment of opinion leaders.[6]

BEHAVIOURAL CHANGE

There is a major corpus of literature, with its attendant theories and models, on behavioural change.

A recent review for the Agriculture and Horticulture Development Board (AHDB) of the United Kingdom (Rose et al 2018) is an interesting reference in the context of this report because it takes behavioural change (rather than 'extension') theory as its starting point. The review, 'Understand how to influence farmers' decision-making behaviour: A social science literature review' by the University of East Anglia draws upon 200+

[6] http://www.toolsofchange.com/en/home/

international papers, including seven from Australia. While the review is primarily about behavioural change in farmers, it also includes observations from fields such as public health and psychology.

The AHDB review makes a number of recommendations in respect to effecting change in individual farmers and at a community level (Table 2).

Table 2: Recommendations to AHDB UK for influencing behavioural change in farmers

INDIVIDUAL FARMERS	WIDER SOCIAL AND ORGANISATIONAL
▫ **Target messages carefully** – identify the audience, understand the messages they respond to, focus on positive benefits rather than negative or 'loss' messages ▫ **Fund and encourage knowledge exchange activities** – ideally face-to-face and active, sustained and continuous, through trusted individuals – and knowledge exchange should be two-way ▫ **Prove the value and ease of adoption –** demonstrate value, preferably recommend actions that are matched with the workflow of the farmer and address relevant tasks (i.e. behaviour change not needed) ▫ **Incentivise behaviour change, including nudging –** ensure rewards can be sustained, and not just financial (e.g. education)	▫ **Encourage a research culture both within and outside of AHDB that is participatory and practice-relevant** – rather than academic ▫ **Involve multiple actors in knowledge exchange** – identify and involve influencers (friends, advisors, family) ▫ **Find ways of communicating with farmers in existing formal or informal networks** – use existing networks where possible, give farmers leadership roles ▫ **Invest in trained facilitators** – to increase face-to-face knowledge exchange ▫ **Recruit 'peer' champions to shape AHDB advice and literature** – include testimonies of peers (fellow farmers or advisors) in publications ▫ **Keep track of ongoing research on peer-to-peer learning** – e.g. through the EU 'Peer-to-peer learning: accessing innovation through demonstration' (PLAID) project ▫ **AHDB could lead a new phase of social change initiatives** – move beyond individual farmer and 'non-adopter' focus to consider all actors, investigate impact holistic knowledge exchange activities in long-term fashion with emphasis on actions taken rather than intent

Source: adapted from Rose et al (2018)

Note the use of the term 'nudging' in the AHDB recommendations. 'Nudging' refers to the use of positive language and scenarios – 'gain' rather than 'loss' messaging – and making behavioural manipulation as subtle as possible, to reduce the 'inertia caused by a reaction against an attempt to change behaviour' (Rose et al

2018). Thaler and Sunstein (2008, cited in behavioraleconomics.com[7]) give the example that 'putting fruit at eye level counts as a nudge. Banning junk food does not'. Nudging is most associated with the behavioural economist Richard Thaler.

3.2.3 ROLE OF COMMERCIAL FARMS

Crawford et al (2007) reviewed the involvement of commercial farms in innovation projects and explored the conditions for effective learning partnerships using two case studies from the Australian dairy industry. Four different 'farm' models were examined:

- Experimental / trial farms: 'used to assess new technologies or specific changes to a farming system within a commercial farm context';
- Demonstration / focus farms: 'typically established by interested farmers to address a specific technical issue or track a period of change, the main focus being the physical and financial performance of the farm';
- Companion farms: 'operate autonomously with a consultant or advisor acting as a bridge between the research group and the routine farm management activities, providing a dual farming systems research and extension medium'; and
- Partner farms: 'the most intensive research-extension-commercial farm relationship, where the farm is considered as an equal partner in the overall research program, contributing as co-developers of knowledge'.

The authors found that partnerships with commercial farms can contribute to addressing the conditions of complexity faced by agricultural industries, although they can be expensive to operate. They also found that for effective learning partnerships, there needed to be active negotiation and facilitation of learning roles between farmers, researchers and advisors. They concluded that in the right situation, commercial farms in innovation projects are an effective response to the challenges of complexity in agricultural innovation.

The EU has an extensive network of demonstration farms and an online hub through which these can be accessed.[8] A training kit on how to establish such farms is also available.[9] There is also NEFERTITI (Networking European Farms to Enhance Cross Fertilisation and Innovation Uptake through Demonstration[10]) which has 10 interactive thematic networks and brings together 45 regional clusters (hubs) of demo-farmers along with advisors, education participants, researchers and policy makers in 17 countries.

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[7] https://www.behavioraleconomics.com/resources/mini-encyclopedia-of-be/nudge/

[8] https://farmdemo.eu/

[9] https://trainingkit.farmdemo.eu/3-demo-set-up/

[10] https://nefertiti-h2020.eu

3.2.4 SO, WHAT WORKS?

In our view, current thinking in all of the various disciplines and theories (extension, design thinking, marketing, behavioural change and likely numerous others), as it applies to gaining optimal adoption of innovations in an agriculture context, converges in a set of clear and unambiguous principles. In fact, the recommendations for extension developed by the CVCB in the early 2000s remain robust, albeit that new insights from various sources have added to the richness of our understanding of effective extension since that time.

A review conducted as part of the CVCB identified five models or approaches for capacity building and the features of each that are most likely to deliver successful outcomes (Coutts J&R, 2017). These are summarised in Table 3.

Table 3: Models for capacity building

MODEL	DESCRIPTION	BEST PRACTICE FEATURES
Facilitated groups (peer-to-peer learning) *Example: Wine Australia Regional Program*	Facilitated groups 'increase their own capacity in planning and decision-making and in seeking their own education and training needs based on their situation'. This may include inviting an expert, undertaking research or holding training workshops.	⌗ Self-formed groups are best – by invitation or application rather than open. ⌗ Groups should have guidelines and boundaries and then be allowed to find and select their own facilitator. ⌗ Groups should follow a planning, action and review cycle. ⌗ Provide support and training for facilitators. ⌗ Provide opportunities for groups and representatives to meet and interact with other groups. ⌗ Encourage groups to become self-funding after an interval.

MODEL	DESCRIPTION	BEST PRACTICE FEATURES
Technological development *Example: AWRI research*	Individuals work together to develop specific technologies, management practices or decision support systems that will then be available to the rest of the industry or community. This often involves local trials, demonstrations, field days and on-site visits.	⌗ Look to establishing strong industry-funder-government partnerships, where they are applicable. ⌗ Include a strong on-farm / in-community practice component to ground and test technology or practice change or both. ⌗ Take the broader 'target' community along with you through use of mass media and other communication channels. ⌗ Include local or regional committees to overview direction and developments. ⌗ Use incentives and awards to encourage interest in developments. ⌗ Link in to applied research and tie in with relevant legislation.
Training *Example: Wine Australia 'Growing Wine Tourism' workshops*	Specifically-designed training programs and workshops are delivered to targeted groups of landholders, community members, government personnel and others to increase understanding or skills in defined areas. These can be delivered in a variety of modes and learning approaches.	⌗ Learning events must be based on researched and expressed industry needs. ⌗ Incorporate latest research on the topic. ⌗ Include local examples. ⌗ Allow participants to share their own experience and knowledge. ⌗ Use adult and experiential learning methods, and cater for different learning styles. ⌗ Change the focus to align with the needs of different geographical areas. ⌗ Pilot test the events with a range of participants. ⌗ Use a tried and tested Total Quality Management system. ⌗ Link outcomes with competency standards from the Vocational Education and Training (VET) system from outset. ⌗ Provide for mentoring, particularly of small enterprises, after or between events. ⌗ Use interactive and small group work to balance 'lectures'. ⌗ Allow for participants to develop their 'next steps' by the end of the event.

MODEL	DESCRIPTION	BEST PRACTICE FEATURES
Information *Example: Wine Australia website*	Individuals and groups can access a broad range of information from a distance at a time that suits them. It can be based on a website, information centre or other centralised locations	⌗ If the model is based on a website, the information on it needs to be continually promoted. ⌗ The basis of finding information needs to be intuitive rather than classical 'library'-based. ⌗ Specific information links or access points need to be circulated at timely intervals. ⌗ Some form of 'human' facilitation adds value. ⌗ Scanning for new information and links/linkages with other information initiatives is necessary. ⌗ Linking innovations to information on risks and economics improves the value of the information. ⌗ Case studies / videos of other producers making changes and providing practical 'tips' are powerful.
Consultant *Examples: private viticultural consultants, AWRI helpdesk*	A mentor or consultant works over a period time with an individual or community to improve their managerial, technological, social or environmental situation.	⌗ Consultants and mentors should encourage individuals to understand and make their own decisions based on their understanding of the facts and their own unique situation – rather than providing ready-made answers.

Source: adapted from Coutts J&R (2017), CVCB (2004a, b)

A valuable overview of what works in extension was recently presented to an animal welfare forum[11] by Pauline Brightling of Harris Park, a very experienced group that has designed and delivered a number of highly successful extension programs, especially in dairy. Her key messages were:

- Focus on the change required – be outcomes focused.
- Identify all the stakeholders / players in the space – know their 'what's in it for me' as well as you possibly can.
- Design a set of activities to achieve the change required – using all the relevant levers ('RESET' – regulation, economics, social pressure, education/extension, technology).

[11] https://www.awstrategy.net/uploads/1/2/3/2/123202832/10_brightling.pdf

- Test the logic of your design. Will the interventions lead to the results you want? At the scale required? Is the order of things right? Is the timeline do-able? Are the gaps (knowledge / alignment) identified? Are they addressed? Will the outcomes (not just the activities / outputs) be measurable?
- Keep in mind some (road tested) success factors:
  - planning is doing – a $250–500,000 project generally needs 4–6 months solid planning
  - design is a team event
  - the focus is route to change, not route to market
  - the adage about quality – time – cost (inputs) holds true: pick any two!
  - design for the scale needed
  - avoid the chasm effect – the leap of faith from a list of activities to achievement of lofty goals
  - resolve issues 'upstream' – it takes effort, but the rewards are huge
  - use multipliers such as peak bodies, service providers wherever possible
  - pilot new or tricky elements in the target environment with enough time to adjust, and
  - respectful interrogation and reflection are very valuable tools.

There are marked similarities between Brightling's recommended approach and the 11 'benchmark criteria' for effective social marketing (see above).

3.3 ADOPTION APPROACHES OF OTHER RDCS

It is instructional to consider the extension / adoption activities of a range of other agricultural sectors. Meat & Livestock Australia (MLA), Dairy Australia (DA), Cotton Research & Development Corporation (CRDC) and Sugar Research Australia (SRA) were examined and key elements of their approach described below.

3.3.1 MEAT & LIVESTOCK AUSTRALIA

Meat & Livestock Australia (MLA) has moved towards a more participatory approach in its extension and adoption strategy. It has a Producer Consultation and Adoption Business Unit headed by a General Manager. MLA delivers the results of its R&D investments by providing producers with education, training and opportunities to change on-farm practice through a range of programs including:

- More Beef from Pastures – combining an online manual with regional events and workshops.
- Making More from Sheep – providing a best practice package of information, tools and events.
- Give Goats a Go – providing a guide that explains the essential processes for successful goat production.
- FutureBeef – a collaborative program assisting graziers and the beef supply chain in northern Australia.
- EDGEnetwork – workshops that focus on business, breeding, nutrition and grazing management skills.
- Producer Demonstration Sites – applying and further developing R&D results in commercial settings. Over 30 producer groups are running projects currently, and MLA has recently increased resources in this area significantly.
- Profitable Grazing Systems – equipping producers to improve their business and their bottom line.

- Producer case studies – case studies from cattle, sheep and goat producers across Australia.
- Pastoral Profit – a business-focused program providing professional development opportunities for pastoral producers.

More recently, to increase adoption of new knowledge and technology, MLA has announced its Accelerated Adoption Initiative, which provides temporary relief for costs incurred for the delivery of key MLA products and services such as training workshops, forums, field days and genetic services. Most of these activities have involved a partial user-pays component, especially where private benefits are realised (for example by seed stock producers through Sheep Genetics).

MLA also operates a demonstration farm at Carwoola Pastoral Company, a 2000-hectare mixed livestock and cropping enterprise near Canberra. MLA and various solution providers have installed a range of tools encompassing connectivity, animal monitoring and tracking, asset monitoring and tracking, human safety, analytics and user interfaces. A further five properties are intended to be rolled out as part of the same project.

3.3.2 DAIRY AUSTRALIA

The Regional Development Programs (RDPs) are an important and distinguishing feature of the Dairy Australia (DA) model. There are eight RDPs. They have differing histories extending over almost 20 years and, until recently, adopted a range of governance and operational models. In 2014, DA commissioned a review of its regional services (including the RDPs) by Coutts J&R. This review was partly a response to the ongoing withdrawal of state government extension services to agricultural industries, resulting in a recognition that dairy would need to take responsibility for its own extension delivery.

Among the conclusions of the Coutts review were that DA should adopt a more consistent and coordinated approach to its regional service delivery and that there were opportunities to streamline the administrative functions of the RDPs to allow them to focus on their core purpose.

During 2014 and 2015, DA and the RDPs worked together to develop and implement a new RDP model across the eight organisations. The new model saw DA provide administrative and other support services to the RDPs by DA, the recasting of the role of the Executive Officer of each RDP to ‘Regional Manager’ and the employment by DA of all RDP staff, with secondment back to their RDPs. The RDPs continued to exist as separate entities with independent boards or committees.

In 2015, DA also took over the delivery of dairy productivity extension services from the Victorian government, with extension personnel subsumed into the three Victorian RDPs. In WA, Western Dairy formed part of a ‘Dairy Hub’ in which DA and the WA Government invested, although this has since folded.

The RDPs act as more of a regional DA ‘shopfront’ and two-way conduit between regional dairy farmers and centralised DA activities than they used to. However, there has been a lack of clarity among levy payers as to the respective roles of and relationship between DA and the RDPs, despite efforts to reduce confusion through a co-branding strategy.

There are formalised opportunities for the RDPs to interact with each other and with ‘head office’ through biannual meetings at DA involving the chair, deputy chair and regional manager of each RDP. The first is in March and includes a ‘speed dating’ format that allows each RDP to interact with each of the DA program managers (e.g. feed base, animal production etc). The second meeting is in November, in conjunction with the annual general meeting, and allows a two-way exchange of information between the RDPs and DA at a strategic level.

Each RDP prepares and submits a draft annual operating plan in March and finalises the plan in June. It is understood that the process of negotiating the regional plans enables an adequate degree of regional prioritisation while maintaining alignment with national strategies.

The dairy industry has also operated dairy demo farms over the years and one still functions,[12] although it is no longer supported by Dairy Australia. The purpose of these farms was to test and demonstrate systems of farming that had the potential for improving the productivity, profitability and sustainability of farms. Dairy Australia no longer invests in these programs but it does operate a Dairy Farm Monitor Project, which provides an analysis of 250 farms (like a benchmarking project) to help inform decision making and prioritisation by key stakeholders across the industry. Dairy Australia has indicated that demonstration farms require very good management and oversight, but need to be constantly monitored that they are demonstrating best practice and can be expensive to operate.[13]

3.3.3 COTTON RESEARCH & DEVELOPMENT CORPORATION

Cotton Research & Development Corporation's (CRDC's) extension is managed through CottonInfo, formed in 2012 following the closure of the Cotton Cooperative Research Centre, by three joint venture parties: CRDC, Cotton Seed Distributors (CSD) and Cotton Australia, each of whom contribute funding to the program. CottonInfo was established in response to the decline in public extension activities by state departments of agriculture. CottonInfo has been structured to enable research outcomes to be delivered directly to growers through a common extension platform. This platform comprises:

- information resources
- regional extension officers, funded by CSD, who are responsible for a range of activities within regions, and
- technical specialists, funded through a CRDC project, who provide high level advice and direction in the key areas of cotton production.

CottonInfo has a dedicated manager within CRDC who reports to the Executive Director of CRDC and to a management committee made up of representatives of the joint venture partners. There is a team of 18 people, but individuals within the team each report to their own employing organisations rather than to the CRDC CottonInfo Manager. There is a strategic plan for CottonInfo that links closely to the strategic plans of the partners.

Extension has been built into all CRDC projects, which include a specific milestone requiring the development of an 'adoption pathway' that is applicable to the project. Researchers are not expected to be extension specialists but are encouraged to work with CottonInfo to ensure the results of their research are effectively extended.

[12] https://macalisterdemonstrationfarm.com/

[13] Personal communication

CottonInfo works closely with myBMP (best management practices), a 'voluntary farm and environmental management system' and jointly produces with CRDC two publications each year: the Australian Cotton Production Manual and the Cotton Pest Management Guide.

CottonInfo is held in high regard by industry. It is apparent that the success of CottonInfo is heavily dependent on the engagement and relationships that the regional extension officers can generate and maintain within the cotton regions. They tend to provide very good generic extension and support for cotton growers, but most of the key management decisions that are made in cotton production are usually completed in conjunction with either a private consultant or a company agronomist / consultant.

3.3.4 SUGAR RESEARCH AUSTRALIA

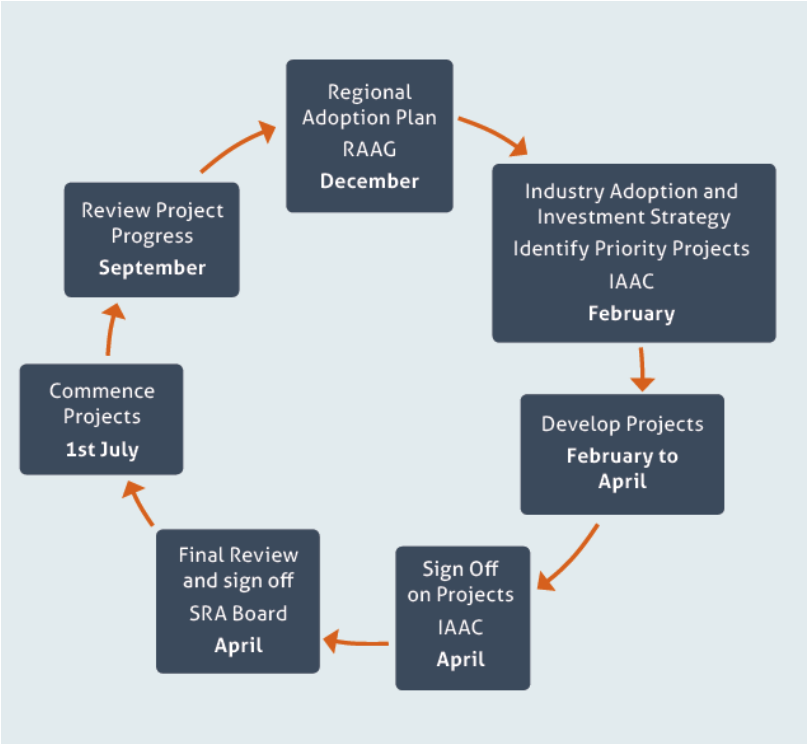
Sugar Research Australia (SRA) has recently transformed its extension and adoption strategy by moving towards a regional model employing staff to coordinate adoption activities. In 2017, SRA finalised its industry adoption strategy which seeks to 'accelerate the application of technologies and practices that lead to targeted and measurable practice change'. The development involved a review of successful models in other industries and extensive consultation with stakeholders.

The key features of the Industry Adoption Strategy are:

- Investment strategies are developed at the six regional levels and at an industry level that focus on practice change.
- Regional Adoption Advisory Groups (RAAGs) identify regional priorities that are then developed by Regional Adoption Advisory Committees (RAACs) into a Regional Adoption Strategy and an Annual Operating Plan.
- These strategies are provided to an Industry Adoption Advisory Committee (IAAC), which develops an industry adoption and investment strategy based on the priority projects for investment identified from the six regions. The IAAC makes recommendations to the SRA Board for funding approval once projects have been fully developed.
- Project are then commissioned including seeking co-investment by other state and federal investors.

This is summarised in Figure 3.

Figure 3: SRA adoption investment annual cycle



Source: SRA 2018

Staffing involves an Executive Manager for Regional Coordination, 6 regional co-ordinators and a further 14 adoption officers. There are two streams of funding:

- core funding to resource industry and regional coordination in the 6 key cane regions and core resources (staff) within each region to enable effective delivery of the model, and
- an Industry Adoption Fund to resource regional and cross-regional projects developed in regions and where possible linked across regions, which have been designed collaboratively to address strategic industry issues.

3.4 RELATED REVIEWS OF WINE EXTENSION IN AUSTRALIA

GWRDC EXTENSION REVIEW

This review follows a previous review on extension and adoption undertaken by BAEconomics (2014). The review was commissioned to examine the (then) Grape and Wine Research & Development Corporation's (GWRDC's) extension and adoption activities and evaluate their effectiveness in encouraging and facilitating practice change arising from R&D outputs. The scope and objectives of the review were to:

- Understand the effectiveness of the innovation and adoption activities funded by GWRDC; including an analysis of the scope and outcomes of the activities against both the intended scope and outcomes and Innovation and Adoption Strategic Objective;
- Understand the value of the innovation and adoption activities to the Australian wine sector; including an analysis of the cost of each activity (allowing accurate comparison) and an analysis of the effectiveness of the activity against the aims of the Innovation and Adoption Strategic plan; and
- Recommend changes to GWRDC support of current innovation and adoption activities (if necessary).

BAEconomics made nine recommendations. These are listed in Appendix 2, along with a response from Wine Australia as to the status of the recommendations made.

The bulk of the recommendations were actioned, with two exceptions.

Recommendation 1: That for future years GWRDC considers the following:

- Setting strict KPIs against …….. *(actioned)*; and
- Determine topics jointly with AWRI and the relevant regional body, select the topics that are most relevant to the particular region and limit the number of topics to ensure that presenters are properly focussed on the event *(not actioned, topics continued to be selected by AWRI without direct GWRDC – or Wine Australia – involvement)*; and
- Make funding for each activity contingent on the relevant regional body making a contribution to the cost of the function – this could be an in-kind contribution – to help ensure that significant local effort is made to encourage as many participants to attend as possible *(not actioned – considered that regional bodies are already making an in-kind contribution)*.

Recommendation 2: That GWRDC considers the future workshop and seminar program in parallel with the proposed [AWRI] roadshow program to ensure that topic coverage is coordinated and that regional coverage is at least partially consistent with levy contributions. At the same time, attention should be paid to ensuring that funding is available in establishing regions particularly as growers adapt to any climate change.

Not actioned. AWRI continued to develop workshop programs based on perceived emerging issues and run a separate roadshow program, with overlap avoided organically. Coordination between the two is not a major focus. GWRDC / Wine Australia is advised of, rather than involved in, decisions.

The two primary 'not actioned' recommendations both relate to collaboration between Wine Australia and AWRI in establishing priorities for subsequent extension activities. While the Australian Wine Extension Network plays some role in this regard, it is not clear how effective this is. Greater collaboration between AWRI and Wine Australia would be advantageous.

In addition, it appears that 'practitioners' play little part in providing oversight of extension priorities. Their engagement would be beneficial and consistent with contemporary extension and adoption thinking.

DRIVING ADOPTION OF TECHNOLOGY

Wine Australia commissioned AgThentic (2019) to identify 'practical, actionable ways to increase awareness of, engagement with, and adoption of agriculture and food technology (AgTech) solutions'.

The report made four key recommendations based on findings from interviews and surveys with Australian and international wine grape sector participants and a global scan of commercially-available AgTech. The recommendations were to establish:

1. Common infrastructure services – a database of AgTech options, trial data and communication products and services;
2. Focus vineyards – a regionally based demonstration site largely based on the SA Central model;
3. Collective action – provision of grants that are accessible especially to smaller growers and service providers to overcome adoption barriers such as affordability; and
4. Competitive clusters – designed to encourage collaboration between AgTech companies, start-ups and producer groups to solve a specific problem.

The report notes that there is no one solution that will meet the needs of all parts of the sector. It suggests that, given the broad range of challenges and technology solutions available as well as the varied needs and constraints of individual users, a solitary demonstration site will not be effective in driving adoption. Instead AgThentic suggests a way forward for each of the four recommendations with the interface between the 11 regions and a Community Technology Manager (either employed by Wine Australia or another organisation) being key. Identifying the problems unique to each region and then tailoring an approach to best suit is favoured.

3.5 TRENDS IN THE EXTENSION AND ADOPTION LANDSCAPE

The system in which extension and adoption operate – agriculture, the broader economy and even society generally – is rapidly changing, and these changes have implications for the way extension and adoption are managed. These include:

- **Increasing complexity at all levels.** For example, the recently-completed 30-year vision for the Australian wine sector notes the emergence of synthetic 'wines' and other synthetic beverages, the explosion in the variety of beverages now offered to consumers and the blurring of lines between the traditional categories of wine, beer and spirits. Consumers are becoming more discerning and are demanding healthy, high quality foods that carry high ethical standards. Producers are expected to continuously innovate while also meeting and demonstrating high standards of food safety, environmental care and social responsibility.
- **The accumulation of 'wicked' problems.** Society is wrestling with issues such as climate change, biodiversity decline and excessive waste that demand complex, multi-stakeholder solutions. Agricultural industries are more exposed than most others to the negative impacts of some of these problems, including extreme weather events, water shortages, fires and changing patterns of pests and diseases.

- **The emergence of agtech** (electronics, drones, big data, the Internet of Things, artificial intelligence, decision-support systems and so on) as the major type of innovation in agriculture. A number of RDCs, including Wine Australia, have recognised that agtech presents particular opportunities and challenges and may necessitate a different approach to RD&E to that used for more 'traditional' types of innovation. This is further discussed below.
- **The exponential increase in the availability of information and its instant availability.** Information has never been more plentiful, but neither has misinformation, with the result that many people are confused about what or who to believe – with the end result being a possible propensity to do nothing. This trend is closely linked to a loss of trust among the public in many institutions including governments.
- **Increasing pressure on government budgets, especially in relation to agricultural innovation.** State governments have progressively withdrawn from providing extension services on the basis that they deliver private benefits. At the federal level, the RDC model is being reviewed and a specific area of interest is how to 'drive collaboration and participation across the agricultural innovation system, with a focus on better cooperation and improved adoption of R&D' (Commonwealth of Australia 2019).
- **Concentration of ownership within value chains.** The consolidation of players in most agricultural sectors, that is, the shift to fewer, larger enterprises potentially changes the way R&D funding bodies manage their adoption function. Dairy Australia, for example, has a specific mechanism for interaction with its largest levy payers, whose innovation priorities differ in some respects to those of smaller businesses. Larger players may have in-house technical capacity, different innovation priorities to smaller businesses and/or a greater propensity to adopt new practices or technologies – or not.

A literature review prepared for the Red Meat and Wool Extension Blueprint Working Group by Nettle (2013) identifies a number of developments in agricultural innovation worldwide in recent years. Most of these can be seen to be a consequence of the trends described above. They include:

- An international trend towards **increasing privatisation of the RD&E system as a whole**. Traditional RD&E is being re-organised towards collaborative, trans-disciplinary groups including producers, such that research is no longer the driver of innovation.
- **Adapting existing knowledge is the primary activity of innovation**, particularly in developed countries where there are large stocks of existing knowledge.[14]
- The creation of **credible, accepted and useful information resources** is increasing in importance. This requires deliberative processes, involving a range of stakeholders and expertise, and these are resource-intensive. The value of these resources can be enhanced by linking them to sector professional development and training systems.
- Whilst information resources are important, effective **innovation is also dependent on working within and influencing the socio-cultural environment**.
- **Strong farmer and societal engagement** in determining innovation priorities are prominent in international approaches.

[14] We note that this is consistent with feedback from consultations conducted for this review and for the wine sector strategy, to the effect that the Australian wine sector has a large bank of data and information that needs to be better utilised.

- Internationally, there are efforts to **increase demand for advisory services and increase acceptance of paying for advice**.

3.6 KEY FINDINGS

This section – which has looked in overview at current thinking in extension and related disciplines, the activities of other selected RDCs in relation to extension and adoption, previous reviews of the grape and wine sector's extension and trends in the landscape – leads us to the following broad conclusions:

- The traditional linear approach to RD&E should no longer be the default model.
- Whether extension, marketing, behavioural change, design thinking or other theories are used as the template for an adoption strategy, the success factors are very similar. These have been described above but, in summary, place great emphasis on multi-stakeholder, participatory RD&E based on a deep understanding by the promoter (such as an RDC) of the groups involved and their attributes.
- A range of extension and other approaches must be offered, to cater for the various needs and learning styles of stakeholders.
- Other RDCs are recognising these developments and changing their extension and adoption strategies accordingly.
- Trends in the operating environment for extension and adoption, and in agricultural innovation worldwide, indicate that the need for innovation systems that deal with complexity, involve multiple players and allow users to confidently navigate vast quantities of information will only increase.
- Target audiences are likely to be far more responsive to changing practices if the 'promise' of benefits is clearly made and the source is trusted.

4. REVIEW OF CURRENT SECTOR EXTENSION AND ADOPTION INITIATIVES

4.1 FINDINGS OF SURVEY AND CONSULTATIONS

4.1.1 SURVEYS

Over the period of this review, several surveys were undertaken that provide valuable insights into the impact of the general extension (and communication) activities in the wine sector.

AWRI

Soon after this review was announced, the AWRI commissioned an evaluation of current extension activities by First Person Consulting entitled 'AWRI practice change evaluation'. The evaluation 'sought to understand the appropriateness and effectiveness of extension services and events and provide suggestions and recommendations for ongoing delivery of extension activities'.

The evaluation involved a survey of people who had used or accessed AWRI extension services or attended extension events in the last two years. The general findings of the survey were very complimentary about AWRI's activities. Some key findings from the survey were:

- 733 responses were received from a target of approximately 1900 people (an impressive 39% response rate);
- The most commonly used AWRI services were the website (96% of respondents) and the helpdesk (81% of respondents);
- 87% of respondents stated that the usability of information from extension events was 'above average' or 'excellent';
- 66% of respondents reported they had adopted a new practice or changed their practices after accessing AWRI services;
- A more impressive 82% of respondents reported they had adopted a new practice or changed their practices after attending an AWRI event; and
- Interestingly, the survey found a strong desire for case studies of growers' and winemakers' experiences of adopting new practices, with 60% of respondents saying this would help them to adopt practices.

A series of recommendations was made at the conclusion of the report mainly concerning the need for AWRI to continue with its suite of extension activities.

WINE AUSTRALIA – INTUITIVE SOLUTIONS

In 2019, Wine Australia commissioned stakeholder research by Intuitive Solutions 'aimed at gathering feedback from stakeholders across a number of different focus areas, including measuring the "experience" that stakeholders have' across R&D, marketing and communication activities.

Key findings from this survey involving 638 participants were:

- The importance of Wine Australia to provide the services they do was rated 8.9/10;
- Agreement that levies are being invested to achieve expected outcomes was rated 6.8/10;
- 30% of stakeholders reported that they had made changes as a result of acquiring information from Wine Australia or attending an event;
- Extension functions were rated 6.3/10;
- Market insights was rated 7.6/10;
- Communication functions were rated 6.9/10; and
- Ratings were lower for grape-growing-only businesses and for smaller grape-grower and winemaker businesses (compared to their large counterparts).

Interestingly, Intuitive Solutions noted that the results suggest there are a number of opportunities to strengthen stakeholder satisfaction and that ratings were stronger among stakeholders who participate in the opportunities provided by Wine Australia programs. Again, unsurprisingly, the results echo the value of having stakeholders actively participating in programs. This suggests the program 'experience' appears to be largely positive so looking for opportunities to increase uptake of program opportunities should be a focus.

This is an important finding in relation to this review.

WINE AUSTRALIA – J&R COUTTS

Wine Australia also commissioned a survey in 2019 by J&R Coutts which aimed to gain a measure of the adoption of selected winemaking and viticultural practices. Eighty-seven surveys were completed. Some key findings from that report were:

- Overall results were very similar to the 2018 survey;
- Awareness of Wine Australia activities and information had increased slightly (2018: 7.1 avg. and 2019: 7.2 avg.);
- Perceived usefulness of Wine Australia extension activities had also increased slightly (8.0 / 8.1);
- The proportion of respondents accessing information online/mobile had increased since 2018 (e.g. online resources +21%, mobile apps +21%);
- Workshops were the most preferred way to learn about new findings from R&D (46%);
- The most common practice changes made by winemakers over the last three years related to fermentation practices, while for winegrape producers the most common viticulture challenges related to weather and climate, and pests and disease; and
- Wine Australia information, tools and extension activities were overall rated as moderately influential in helping winegrape growers successfully make changes (average 5.9). For wine producers, Wine Australia information, tools and extension activities were overall rated as moderately influential in helping producers successfully make changes (4.9).

It is of interest, from the two surveys that Wine Australia commissioned, that extension activities were rated quite highly even though Wine Australia does not have an active direct extension campaign with wine grape producers or winemakers, as this is sub-contracted to AWRI and others. However, Wine Australia is actively involved in the Regional Program and does have an active communication charter. The results may also indicate that Wine Australia receives some attribution from AWRI's roadshow activities.

4.1.2 CONSULTATION

A number of one-one-one consultations were undertaken specifically for this review, as described above. The key findings from these consultations are summarised below:

- There is general respect for the extension activities of AWRI;
- Seminars and workshops are well regarded although some question whether 'we are talking to the same people all the time';
- There needs to be more hands-on workshops, whether for viticulture or winemaking – people learn by doing or tasting (it is noted that the current AWRI wine tasting workshops are well regarded for this reason);
- There may be an over-emphasis on wine-making activities in the AWRI mix;
- There is a new (next) generation of sector participants who use a lot more digital communication techniques (social media, YouTube, webinars etc), suggesting there should be more use of those media in future;
- Extension should work in with commercial partners wherever possible;
- Consideration should be given to the development of a specific service for very large producers;
- There is strong support for the regional program although:
  - Some regions do not have the human resources to always deliver projects;
  - There is sometimes an inability to identify useful projects in some regions; and
  - The level of administration is high, but not always well acknowledged. Ways to reduce planning and reporting burdens should be constantly examined;
- Identifying all stakeholders is an issue – could greater use be made of Vinehealth Australia which has a register of all SA vineyards (and could this be replicated in other states?);
- In general, there should be more funding for extension services – but first there is a need to better develop the value proposition;
- There was support for some type of demonstration farms where all the latest viticulture (and/or winemaking) technology is on display in a commercial setting. This view is consistent with the recommendation put forward by AgThentic. It is also, in part, consistent with the Vineyard of the Future in Queensland and the focus farms in SA;
- All extension activities need to make a promise to participants – using SMART objectives… 'at the end of this workshop you will…'; and
- There is a degree of 'meeting burn-out' especially in grape growing regions. New ways of engaging with growers are needed (media, topics, locations etc).

4.2 DESKTOP ANALYSIS OF CURRENT INITIATIVES

4.2.1 OVERVIEW

The Australian grape and wine sector uses a range of extension and communication platforms to get research, development, marketing and regulation information to sector stakeholders. Many of these are supported by Wine Australia and include:

- AWRI national program of activities including:
  - Roadshows – seminars and workshops;
  - Helpdesk;
  - Library and library services;
  - Technical articles in industry journals;
  - Website;
  - Webinars; and
  - Newsletters;
- Seminars conducted by the Australian Society for Viticulture and Oenology, primarily with an education focus;
- Webinars by Wine Communicators Australia;
- The Wine Australia Regional Program, for which AWRI is funded to assist with coordination;
- National Wine Research and Extension Network, of which Wine Australia is a member; and
- Wine Australia's communication program.

There is also a range of activities undertaken by public service providers (e.g. South Australian Research & Development Institute (SARDI), NSW Department of Primary Industries) along with private consultants.

Over the last decade or more there has been a significant decline in the sector's extension capabilities (for example, state departments of agriculture moving out of extension), as has occurred across all agricultural industries. AWRI reports that extension 'resources' have been reduced by 74% (from 61 FTE in 2009 to 16 FTE in 2017). For the wine sector, there remains some support from state governments.

4.2.2 AWRI

AWRI is the primary extension service provider in the grape and wine sector.

To assist this review, AWRI prepared a comprehensive document: 'AWRI extension review – for activities 1 July 2017 – 30 June 2019'. This document highlighted activities and outputs as delivered within the current investment plan. It reported, in summary, the following key outputs from AWRI extension activities within the grape and wine sector in 2018/19:

- Responded to ~2,920 requests regarding technical information, professional advice and scientific articles;
- Investigated ~1,000 problem samples and provided confidential, expert advice and opinions to the relevant company;

- Anticipated and proactively responded to industry emergencies such as bushfires, regulatory issues and taints;
- Staged 60 roadshow workshops, seminars and Wine Australia marketing events, attracting 1,478 attendees;
- Maintained a roadshow seminar portfolio currently consisting of 61 presentations, of which 75% are linked to Wine Australia's 5+5 themes;
- Delivered 16 webinars, attracting 620 attendees;
- Supplied technical information through the AWRI website (>500,000 page views), eBulletins, web portals, and mobile apps and through the full-service AWRI library, one of the largest of its kind in the world;
- Substantively planned and organised the workshop program for the (triennial) 17th Australian Wine Industry Technical Conference staged in July 2019, which attracted over 900 attendees in 33 workshops;
- Distributed >11,000 copies of the agrochemical 'Dog book';
- Distributed the 'AWRI Vineyard and Practices Survey'; and
- Conducted professional development courses for industry including Advanced Wine Assessment Courses and themed masterclasses.

AWRI's extension activities are governed by its annual operating plan with Wine Australia. Relevant projects, budget and KPIs are summarised in Table 4.

Table 4: AWRI extension projects

PROJECT NUMBER	TITLE	KEY PERFORMANCE INDICATORS
2.1.1	The staging and conduct of extension programs	- Prepare and deliver a minimum of ten seminars. - Maintain and periodically update a portfolio of seminar presentations. - Prepare and deliver a minimum of eight workshop and other research providers. - Identify and prepare content on topical and seasonal issues drawn from the AWRI helpdesk and existing research for dissemination to industry. - Coordinate and deliver a minimum of 15 webinar presentations. - Deliver Q&A events as required in response to *ad hoc* requests on environmental or technical issues.

PROJECT NUMBER	TITLE	KEY PERFORMANCE INDICATORS
2.1.2	Communication with stakeholders	⌗ A review of current AWRI communications and a new communications plan (N.B. completed in 2017/18). ⌗ An annual schedule of communications to industry. ⌗ An annual review of current content on the AWRI website and a plan for updates and new content development. ⌗ Continued growth in the AWRI's following on social media platforms. ⌗ Increased awareness, evaluation and adoption of research outcomes by the Australian grape and wine community.
2.2.1	AWRI help desk	⌗ Timely responses to helpdesk support requests. ⌗ Winemaking and viticulture investigations of technical problems encountered. ⌗ Trials of new equipment/additives of potential benefit to the Australian wine industry. ⌗ A series of wines made on an annual basis to illustrate a technical issue, which can be used in the roadshow program.
2.2.2	Library services	⌗ A continually updated and relevant collection of print and digital resources for the Australian grape and wine sector. ⌗ A reference and document delivery service for the Australian grape and wine sector. ⌗ A new library management system and catalogue. ⌗ A review of the AWRI's Online Image Collection, and a schedule of updates/improvements. ⌗ Digitisation of rare books and out-of-print materials ⌗ Promotion of the library collection and services through a range of platforms including and enhanced library portal on the AWRI website, AWRI eNews, Libraries Australia and the ANDS.
2.2.3.	Regional Program	⌗ Provision of the role of Regional Program Coordinator to help Regional Program partners develop their strategic priorities and AOPs (including one Regional Partners' meeting). ⌗ Support for regions in the development of their AOPs, which are approved and funded by Wine Australia. ⌗ Provision of feedback on AOPs and end of year reports to each Regional Program partner.

While all five activities listed above are of interest, the greatest focus of this review relates to project number 2.1.1. That said, other components of this review do touch on other AWRI projects listed above.

In relation to 2.1.1 ('The staging and conduct of extension programs') the AWRI extension review provided a summary table of target KPIs against actual for the current planning period (2017–2019) and a comparison against an earlier 4-year period (2013–2016). This summary is reproduced in Table 5.

Table 5: Key adoption metrics for AWRI

METRIC	BENCHMARK	2013-2016 (4-YEAR PERIOD)	2017-2019 (2-YEAR PERIOD)
Total # of roadshow events		126	115
Average # of roadshow events / year	25*	31.5	57.5
Total # of roadshow participants		3,468	2,828
Average # of roadshow participants / year	625*	867	1,424
Overall event rating by participants[15]	85%**	87%	92.2%
Webinars (# of participants)[16]	15	?	32 (1,236)
Usefulness of events rated by participants	80%**	76%	85.1%
Participants' intention to adopt	15%**	N/A	28.7%

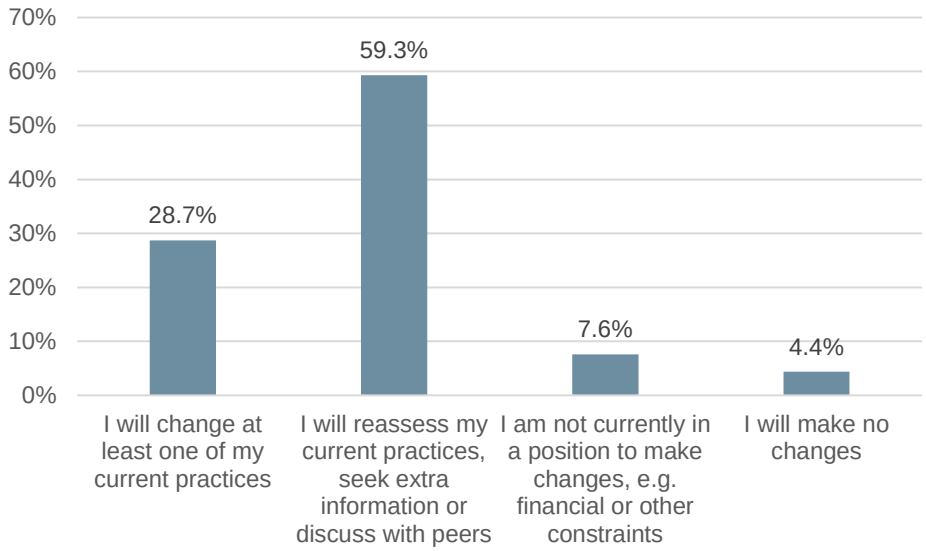
*Wine Australia metrics for 2013–2016
**Wine Australia metrics for 2017–2019

The AWRI report also provides some good figures in relation to 'adoption of practices' as measured by exit surveys from AWRI (Figure 4).

[15] AWRI exit surveys – 'above average' to 'excellent'

[16] Data on webinars not included in AWRI table but has been included by authors

Figure 4: Intention to change practices following attendance at AWRI activities



n=1,151

The AWRI extension review also refers to a number of benefit–cost analyses undertaken since 2012, all of which indicate impressive returns on investment. It also refers to an evaluation undertaken by AgEconPlus, following guidelines established by the Council of Rural Research & Development Corporations (CRRDC), which showed a benefit cost ratio of 3.0 for 'The staging and conduct of extension programs'.

Some points of note in relation to AWRI extension activities are:

- Results of evaluations and impact assessments are generally impressive;
- While it is apparent that AWRI are trying to increase the measurement of outcomes, all other key metrics listed in plans are output-based except for 'intention to adopt';
- The total number of roadshow events is slightly misleading, as it includes Wine Australia marketing activities;
- The figures for event rating, usefulness and intention to adopt differ somewhat from those reported in the First-Person survey, as the above are taken from exit surveys.

AWRI has also provided an attendance record of all seminars and workshop undertaken during 2017/18 and 2018/19 and the topics they covered. Listed below are the year, number of workshops and subjects covered. It is apparent that workshops focussing on winemaking practices were far more frequent than those covering viticultural practices. Workshop topics were:

- 2017/18 – 30 workshops conducted:
  - 4 on spraying;
  - 3 on regional challenges;
  - 2 on smoke-taint; and
  - 21 on wine tastings.

- 2018/19 – 34 workshops conducted:
  - 3 on spraying;
  - 3 on regional challenges;
  - 2 on smoke taint; and
  - 26 on wine tastings.

From discussions with AWRI staff, a review of documentation and consultations with industry, we make the following observations in relation to AWRI activities:

- AWRI provides a comprehensive extension service.
- Workshops and seminars are highly regarded, especially the former.
- Seminars, usually on latest research, can often impose significant time constraints on presenters (e.g. researchers) for small return.
- There is an apparent over-emphasis on winemaking / tasting events. In the recent past (3 years) workshops have been dominated by wine tasting to show the impact of various treatments. Like any hands-on workshops, these are well received. Next year, chardonnay will be the highlighted variety. From then on, AWRI advises that it will then change to working with researchers to take trial wines to market, which will be a more cost-effective approach.
- An ongoing focus on Wine Australia's five key viticulture and oenology practices is, and should continue to be, pursued.
- There needs to be far better definition of AWRI's 'roadshow activities' as there is confusion (at least in our minds) in relation to various 'roadshows' undertaken in the sector (Finlaysons, AWRI). Indeed, the term 'roadshows' could be dropped from the AWRI lexicon.
- Operational plans are very output-, as distinct from outcome-, focussed. In future, objectives and KPIs should be SMART and focus on outcomes. It is suggested that all events need to 'promise' an outcome – i.e. when you leave here you will be able to (ready to implement) because we will not be giving information, but answers.
- The content of seminars is decided by regions, which can select from briefings of the latest research from the researchers involved, and AWRI topics. However, there was some criticism of this approach, and a questioning of whether there a better way of getting workshops and seminars topics agreed than via a long list of topics. An alternative may be face-to-face meetings between regions, Wine Australia, AWRI and the local state departmental representative to review the regional program of the current year, set priorities for the following year and identify what seminars / workshops are needed. Generally, it would be preferable to do a small number of high-quality activities.
- There remains a question as to how regionally-driven workshops (as distinct from seminars) are, given the recent focus on wine-tasting events. This is not a criticism of AWRI as it is reported that regions are often not forthright in expressing their needs.
- Webinars are held at times when specific issues are important e.g. frost, weeds, heat proofing. These are sometimes undertaken specific to a region or, if appropriate, more broadly.
- There is a sense of frustration in some regions in relation to the difficulty of getting people (practitioners) to attend workshops. This is not a situation unique to the wine sector and may in part be addressed by greater use of electronic extension mechanisms.

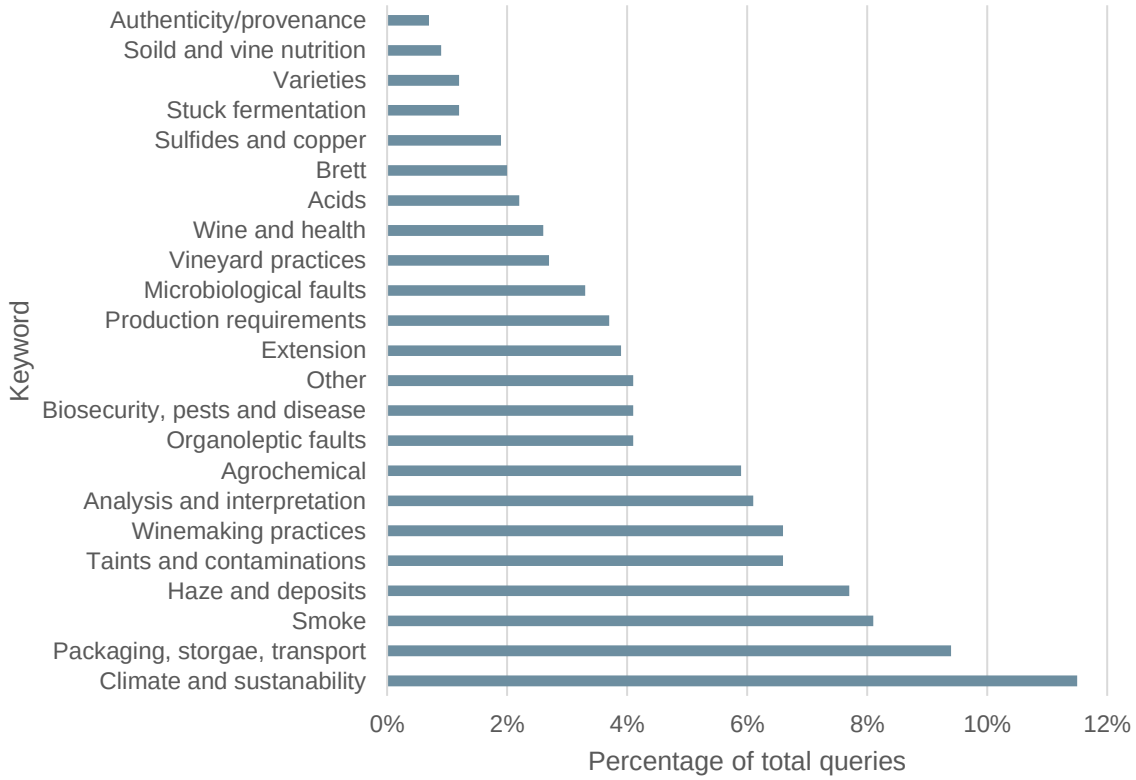
- The AWRI helpdesk was highly praised during consultations undertaken during the Wine Australia performance review and figures referred to above in relation to 'industry contact' are impressive. AWRI reports that, over the last two financial years, its helpdesk staff have responded to 3,736 requests for technical advice (**Error! Reference source not found.**).

Table 6: Requests for technical assistance through the AWRI helpdesk

	2017 / 18	2018 / 19	TOTAL
Winemaking	1,371	1,423	2,794
Viticulture	406	536	942
Total	1,777	1,959	3,736

The topics covered were also reported by AWRI and are reproduced in Figure 5.

Figure 5: AWRI helpdesk query topics – queries received during 2017/18-2018/19 (to 1 May 2019)



FORESTHILL CONSULTING

4.2.3 INCUBATOR INITIATIVE

The Wine Australia 'Incubator Initiative' seeks to identify a specific regional need and then work with regional researchers and sector participants to produce a solution. It is targeted at young (early career) researchers working for an Australian based-research organisation. Up to $20,000 is available for successful applicants to undertake projects, with this funding matched by a co-contribution – cash or in-kind – from the organisation where the researcher is employed. Projects must be aligned with Wine Australia's plans and specifically address a key regional issue.

The Incubator Initiative warrants further time to establish itself. Some feedback provided to this review indicated that the process for obtaining project approval can be quite onerous. There may need to be some slight rebalancing between ease of access for relatively small amounts of research dollars and ensuring adequate governance.

4.2.4 ASVO

The Australian Society of Viticulture and Oenology (ASVO) is a not-for-profit, non-political organisation serving the interests of winemakers and viticulturists. ASVO promotes the dissemination of scientific, technical and practical information through multiple mediums to advance the knowledge and skills of its members. Members of ASVO have access to technical events (including webinars, workshops and seminars) and the Australian Journal of Grape and Wine Research.

More recently, ASVO has been piloting a program in which 200 members will be provided with the opportunity to undertake on-line training in so-called soft skills (information technology, people management, business etc). This is an important development as it recognises the value of such skills as well as providing access electronically and remotely.

4.2.5 REGIONAL PROGRAM

The Wine Australia Regional Program seeks to 'actively encourage and support innovation, extension and adoption of R&D in the Australian wine sector'. The program is similar to several others in Australian agriculture (see section 3.3) and aims to help winegrape growers and winemaker participants reduce the time between the development of new tools or research findings and their adoption.

The program allows winegrape growers and winemakers to identify their region's highest priority innovation or extension / adoption issues and then evaluate potential solutions. The maximum amount of funding available is based on the value of winegrape levies paid in the region (that is, higher-producing regions can access a greater proportion of the total funding pool). To ensure that meaningful activities can be undertaken, regions with lower levels of production are clustered together. In total, there are 11 regional clusters.

Since July 2017 AWRI has played a coordinating role for the Regional Program, which has included the organisation of annual regional partner meetings – in Victoria (2017 – Healesville), Queensland (2018 – Stanthorpe) and Western Australia (2019 – Margaret River). In 2020 the meeting will be held in Tasmania. These meetings appear to be highly valued.

Each region prepares a five-year strategic plan and annual operating plans. Activities funded vary depending on regional priorities but they are generally more participatory in nature than seminars. A review of several plans indicates that they are of variable quality, although this is understandable given the variation in resources

available. One limitation of the operating plans is that the objectives for each project being proposed are not written in SMART terms and do not have a clear monitoring and evaluation plan to assess outputs and outcomes. These limitations could be easily rectified with revisions to the project plan template. A greater focus on communication and monitoring and evaluation in project proposals may also improve effectiveness and measurement of impact.

Within the Regional Program there are some very good projects that are likely to be of interest to more than the local group. Ways to increase sharing of data, information and experiences between regions should be explored further, such as introducing key performance indicators (KPIs) for groups to share more information / experiences.

It is noted that not all regions spend their allocation of funds. This is a situation that needs to be rectified through provision of additional human resources to those regions as required. The point was often raised during consultation about having adequate regional resources to plan and execute projects relevant to that region. Finally, there were some requests for greater flexibility in regional program funding such that projects could be performed over two years. This should be considered.

4.2.6 EXPORT AND REGIONAL WINE SUPPORT PACKAGE

As part of the Australian Government's $50 million Export and Regional Wine Support Package, Wine Australia in conjunction with partners operates two specific training programs, both managed by Hydra Consulting:

1. Growing wine tourism – These are 'regional workshops and webinars for wine businesses looking to enhance their wine tourism experiences and attract more international visitors'. This program involves a two-day workshop and a six-part webinar series that provides practical, wine-specific tools and strategies to help business attract more international tourists to their cellar door. The workshops cover 3 modules:

   a. Module 1: 'Laying the foundations';

   b. Module 2: 'Setting up your wine tourism experiences'; and

   c. Module 3: 'Securing inbound business'.

2. Growing wine exports – These are 'regional workshops and online learning for wine businesses looking to grow their wine exports or give their strategies a health-check'. This program involves two workshop opportunities:

   a. A full-day 'Export Ready' workshop for businesses looking to develop their export strategy; and

   b. A two-day deep-dive 'Export Plan' workshop for businesses wanting to refine their export plan and target commercial/growth opportunities in market.

Feedback obtained to date indicates that these programs are highly regarded. The provider (Hydra Consulting) believes that the main reasons for the strong support for the two programs, as indicated by exit interviews, are:

- The logical flow of the modules making up the training sessions;
- The hands-on approach (learn by doing), in which participants are required to prepare plans and strategies (not just listen);
- Simple messages;
- Focus on story telling; and
- The fact that participants walk out of workshops ready to implement.

4.2.7 BUDGETS

The largest component of Wine Australia's expenditure on extension and adoption is to AWRI at over $2.38 million in 2019/20. A further $725,000 is allocated to the Regional Program, although not all of this is spent each year. Some of the Regional Program projects utilise and fund AWRI input (over and above project number 2.2.3) for the provision of the role of Regional Program Coordinator to help Regional Program partners develop their strategic priorities and AOPs. The remainder of expenditure for extension and adoption relates to staff salaries and on-costs.

The 2019/20 Wine Australia Annual Operating Plan estimates that 6% of the organisation's total expenditure of $79.10 million relates to extension and adoption ($4.74 million). This compares with $21.09 million estimated to be spent on R&D (27% of expenditure).

This raises the question of whether the balance between R&D and extension is appropriate. There is no correct answer to this question, although some guidance is provided by a recent snapshot of RDC RD&E expenditure (taken from 2017/18 annual reports) provided by the CRRDC (Table 7).

Table 7: RDC expenditure on research, development and adoption (extension) – 2017/18

	RDE priorities						% of 2017/18 budget RDE priorities				
	Advanced technology	Biosecurity	Natural resources	Adoption	Total		Advanced technology	Biosecurity	Natural resources	Adoption	
AECL	125,360	853,018	158,204	1,929,019	3,065,601	AECL	4%	28%	5%	63%	
AgriFutures	7,293,000	2,778,000	481,000	9,666,000	20,218,000	AgriFutures	36%	14%	2%	48%	
AMPC	8,125,426	1,746,423	1,813,826	4,325,994	16,011,669	AMPC	51%	11%	11%	27%	
APL	1,831,614	1,539,836	1,089,259	2,931,466	7,392,175	APL	25%	21%	15%	40%	
AWI	14,024,000	1,371,000	1,789,000	20,363,000	37,547,000	AWI	37%	4%	5%	54%	
Cotton RDC	5,123,000	5,519,000	7,180,000	3,086,000	20,908,000	Cotton RDC	25%	26%	34%	15%	
Dairy Australia	13,185,600	321,600	2,572,800	16,080,000	32,160,000	Dairy Australia	41%	1%	8%	50%	
Fisheries RDC	4,903,266	2,208,187	10,514,573	4,946,867	22,572,893	Fisheries RDC	22%	10%	47%	22%	
Forestry RDC	4,690,000	360,000	3,320,000	2,860,000	11,230,000	Forestry RDC	42%	3%	30%	25%	
Grains RDC	45,500,000	36,900,000	34,000,000	28,600,000	145,000,000	Grains RDC	31%	25%	23%	20%	
Hort Innov	10,700,000	63,300,000	12,900,000	20,400,000	107,300,000	Hort Innov	10%	59%	12%	19%	
LiveCorp	95,000	0	77,000	590,000	762,000	LiveCorp	12%	0%	10%	77%	
MLA	90,100,000	12,500,000	5,600,000	63,700,000	171,900,000	MLA	52%	7%	3%	37%	
SRA	13,391,000	8,321,000	7,161,000	3,832,000	32,705,000	SRA	41%	25%	22%	12%	
Wine Australia	9,166,900	856,800	8,546,600	5,393,400	23,963,700	Wine Australia	38%	4%	36%	23%	
	228,254,166	**138,574,864**	**97,203,262**	**188,703,746**			**31%**	**16%**	**18%**	**35%**	average
							36%	**11%**	**12%**	**27%**	median

Source: CRRDC

The CRRDC figures suggest that Wine Australia (at 23%) is below the average of all other RDCs (average 35%, median 27%) in relation to its expenditure on extension across its RD&E portfolio. We also note that at least two of the RDCs with a lower proportion of investment in extension (Hort Innovation and SRA) have recently signalled a greater focus on extension, which may bolster their investment in this area.

However, any comparisons must be made with extreme caution, as there is undoubtedly variation in the way in which different RDCs define 'extension', what constitutes an 'extension project' for the purposes of the calculation, and how costs are allocated when projects cover more than one stage in the innovation cycle (e.g.

projects that involve 'development' as well as 'extension'). Moreover, sectors differ substantially in their circumstances. Some have substantial stocks of innovations that have been poorly adopted and extension is a strategic priority. Others – such as the grains sector, arguably – may have strong uptake of the outcomes of research and other sources of innovation and instead focus their investment on generating new knowledge.

It might also be reasonable to say that the rise of agtech argues for a greater emphasis on extension or at least development plus extension activities by industries. A massive wave of innovation is becoming available, much of it from the private sector, but much of it requires translation, adaptation or demonstration for application by specific sectors.

Our sense, overall, is that Wine Australia could shift its focus and resourcing more towards extension and adoption. There was a distinct theme at the sector planning workshops and in the consultations for this review that there is a substantial body of knowledge available to grapegrowers and winemakers, and that it is under-exploited and under-utilised. Precisely what the optimum figure is should be a matter for discussion in the preparation of the new Wine Australia Strategic Plan (2020–25). We suggest that an increase in extension and adoption funding of 25% or even more above current levels would not be unreasonable.

5. CASE STUDIES

A range of good examples of extension activities working well in practice were identified during the course of this project.

Case study 1: Managing grapevine trunk disease – an integrated adoption process

Overview and summary of impact

Warren and Sue Smith operate Pyramids Road Wines in the Granite Belt region of southern Queensland. Their focus is 'on the production of high-quality, low volume wines'. They also state that 'small scale production means most operations are hands-on – from pruning, training, picking in the vineyard to basket pressing, bottling and labeling in the winery'. They produce several red, white and rosé varieties and styles.

As a direct result of winery visits, workshops and practical demonstrations from experts in trunk disease the Smiths have progressively been reworking their vineyard to both fix the problem of trunk die-back and implementing preventative mechanisms to avoid the problem in the future. This early intervention, taking samples from the vineyard, having them analysed, and then showing the Smiths what to do about it meant the impact has been huge, 'they couldn't believe how much of a difference it made to the vineyard'.

The situation

Grapevine trunk diseases such as eutypa and botryosphaeria dieback contribute to grapevine decline, reducing productivity and longevity, causing considerable economic loss to the Australian wine industry. In 1999 it was estimated that eutypa dieback cost South Australian growers up to $2800 per hectare through lost production (Wicks and Davies, 1999). More recent case studies listed on the Wine Australia website (https://www.wineaustralia.com/growing-making/pest-and-disease-management/eutypa-dieback) show yield increases from reworking eutypa-affected vines from 3.5 t/ha to 7.0 t/ha (Adrian Hoffman) and from 2 t/ha to over 7 t/ha (Karl Schiller).

Trunk pathogens infect vines through pruning wounds, colonise woody tissue and cause dieback of cordons and trunks. Management of trunk diseases is based on removing infected wood material and preventing infection through pruning wounds.

In the granite belt in Queensland, the main cause of trunk disease is the fungus Botryosphaeria.

Connection with research and extension activities

In November 2013 a technical delegation from the South Australian Research and Development Institute (SARDI) and the National Wine and Grape Industry Centre (NWGIC) undertook a deliberate three-pronged approach to assisting growers in the Granite Belt – visiting vineyards to assess the problem, collecting samples and having them tested; running a technical workshop; and farm walks with practical 'hands-on' demonstration of how to fix the problem. There is also a very good report on the 2013 Queensland study tour that led to the Smiths progressively reworking their vineyard.

Details of the impact

Survey – understand the issue and prevalence

Thirteen vineyards (55 blocks) were initially inspected in November 2013 across two Queensland wine regions, including the Smiths' block. On each block, 200 vines were visually assessed for symptoms of dieback (i.e. two or more spurs dead) and the presence of foliar symptoms characteristic of dieback. Samples of wood with

dead tissue were collected where symptoms were observed and taken back to the NWGIC laboratory in Wagga Wagga for diagnosis.

Workshops – convey the solutions

Workshops were held and a summary of the survey results provided, followed by a comprehensive presentation on managing dieback, based on research at SARDI, NWGIC and around the world over the past decade. The workshops were concluded by outlining practical recommendations for managing grapevine trunk diseases in Australia.

Vineyard walk – demonstrate the strategies

Following the workshop, a walk was taken in the vineyard with growers to observe vines with trunk disease symptoms and to directly demonstrate control strategies for trunk diseases.

'Without these hands-on demonstrations, we wouldn't have had the confidence to rip into the vines and go as hard as Dr Mark Sosnowski was suggesting', Sue Smith said

Relevance to others

The approach taken by Dr Mark Sosnowski and his colleagues is applicable to many other vineyard issues. It also lends itself ideally to regions seeking support from Wine Australia's Regional Program to implement programs that deliver knowledge and skill enhancement and practice change to levy-payers in vineyards and wineries.

There is an excellent best practice manual for grape growers and viticulturists produced by Wine Australia 'Best practice management guide', Version 2.0, July 2019, Grapevine trunk disease.

Case study 2: Demonstration Vineyards

Overview and summary of impact

There are currently 8 demonstration vineyards in the Barossa and Clare Valley.

The vineyards are located at:

- Vine line
- Light Pass
- Ebenezer
- Krondorf
- Eden Valley
- Gomersal
- Nuriootpa (x2)

Launched in 2014/15 with funding from Wine Australia, the vineyards demonstrate the benefits of modern vineyard management techniques such as mid-row swards (particularly native grasses) and mulch under-vine to improve water infiltration, reduce vineyard temperatures, improve soil health and increase biodiversity. The project shows, rather than tells, growers the benefits of these techniques, combined with improved pruning and introduction of catch-wires.

They aim to demonstrate:

- improved water infiltration (reduces water and pumping costs).
- reduced vineyard temperatures, particularly night-time.

- more ability to withstand heatwaves, therefore improve yield and quality.
- improved soil health and therefore more consistent yield (while also reducing `traditional' inputs/costs such as chemicals, fertiliser, fuel, machinery).
- reduced tractor passes, fuel, chemical and fertiliser costs (reduces compaction and erosion, whilst increasing vineyard profitability).

There are a number of case studies and videos showcasing the impact of the demonstration vineyards available on the Wine Australia website. Two examples are provided below.

The situation

Soil and vine health is a critical input to successful vineyards especially as they will come under increasing water and temperature challenges. The Barossa demonstration farm program seeks to work directly with growers in commercial settings to showcase a range of modern viticultural techniques that would improve soil health to produce more consistent yields; reduce reliance on traditional inputs such as fertilisers, chemicals and fuel; and potentially improve fruit and wine quality – all of which would also improve vineyard profitability.

These techniques include mulching, soil moisture monitoring, canopy health-based irrigation scheduling, catch wires, non-competitive mid-row grasses and remedial work to eliminate eutypa. Eutypa dieback is the major disease problem in the Clare Valley, with estimates of as much as 30% infection in many vineyards, leading to significant reductions in profitability.

Connection with research and extension activity

A Wine Australia funded eutypa project, which is led by Dr Mark Sosnowski from the South Australian Research and Development Institute (SARDI), will have three deliverables for growers in the Clare and Barossa regions:

- a resource kit, including fact sheets and a short video, extending the latest information from SARDI research combined with local knowledge and management tips regarding prevention practices and treatment of the disease.
- a workshop to present the resource kit, discuss vineyard assessment and summarise the latest research and issues surrounding the adoption of various prevention and control strategies.
- a vineyard assessment program which would supply grape growers with the knowledge from current research and development to recognise disease symptoms in the field.

This field assessment will allow grape growers to apply appropriate decisions regarding eutypa management, particularly with respect to vine age and grape variety.

The key characteristics of the project of importance from an extension / adoption perspective are that it:

- focuses on an issue(s) of importance to producers
- provides a 'single source of truth' via a multi-facetted resource kit
- provides a hands-on learning environment via a workshop
- provides producers with an assessment program that allows them to be implementation-ready
- provides lots of farmer-useful data.

Details of the impact

Adrian Hoffmann, the proprietor of Dimchurch Vineyards, has spent 10 years fine-tuning a eutypa reworking method that he believes has been key to reinvigorating his vineyard to deliver improved yield and quality. With yields as low as 3.5t/ha in the mid-2000s, Dimchurch Vineyards now reworks four to five hectares every year. The reworking has pushed yields back up to around 5.5 to 6.5 t/ ha and maintained them at that level. Yields

in excess of 7t/ha have been achieved and the quality has been far superior to what it was even when yield was only 3.5 to 4.5t/ha.

Menglers Hill was achieving less than 2t/ha fruit production in 2014 so they instigated a reworking program cost $2 per vine or $3000 per hectare and returned yields to 6.5 to 7 t / Ha. See the case study here.

More than 120 Barossa growers and technical viticulturists turned out to attend a 'vine health' workshop held after the 2019 vintage – and another 50 attended a Clare Valley workshop on the same topic. The workshop program included a discussion of the vintage 2019 results of the eight demonstration vineyards being run by Barossa Grape & Wine (BGWA) and Clare Valley Wine & Grape (CVWGA) regional associations. In a survey of written grower feedback 88% rated value of the event high or very high; 76% rated 'knowledge gained from speakers' as high or very high; and 92% rated 'overall service from BGWA' as high or very high.

Relevance to others

The demonstration vineyards provide an approach that is appealing to a wide range of producers and facilitates improvements in producer knowledge which can lead to significant practice change.

Case study 3: Growing Wine Exports - workshops

Overview and summary of impact

Wine Australia funded Hydra Consulting to design and deliver this comprehensive skill development program as part of the Australian Government's $50 million Export and Regional Wine Support Package ($50m Package).

The one-day 'Export Ready' sessions and two-day 'Export Plan' workshops are practical, wine-specific and heavily subsidised by the $50m Package, offering tools, strategies and case studies to help business navigate markets with the largest growth potential – such as China where, over the last six years, the value and volume of Australian wine exports has grown considerably.

The situation

Many wineries would like to export but don't have the tools, skills or strategies to enable them to do that. The one- or two-day workshops provide a very hands-on and practical way to obtain those skills and to adopt the tools needed to be successful.

Connection with research and extension activities

The program was designed with a number of experts, drawing on various sources from research, consumer and market evidence to deliver a diverse range of topics:

- new tools and strategies for navigating export markets
- exporter case studies
- detailed market insights for identifying market suitability
- practical advice on protecting your brand and calculating risk
- a live video hook-up with Wine Australia's USA team
- a Chinese dining experience and insight into Chinese business practices
- advice on refining market intents and wine offer
- a review of key market analysis, and
- the ins and outs of identifying importers and distributors, mastering a brand pitch and preparing for a market visit.

The program claims the following skills will be learnt, delivering a clear promise to participants:

- preparing for a market visit
- pitching your brand
- finding a distributor
- outpacing your competitors
- navigating export laws
- pricing for profit, and
- maximising success in market.

Details of the impact

Between 2015 and 2019:

- total free on board (FOB) export value has increased by 47 per cent from $1.9 billion to $2.78 billion, with value growth in all price segments; and
- the average value per litre of bottled exports has increased by 27 per cent, from $4.90 per litre to $6.24 per litre FOB.

Exports are a crucial part of the market for Australian wine, being 45% by value and 62% by volume of all sales.

Naturally, it is not possible to attribute growth in exports to the workshops themselves. However, there are some output and attitudinal measures to provide some degree of confidence that the workshops are likely to have made a positive contribution to export.

In 2018/19, 58 Growing Export Markets and Growing Wine Tourism workshops were delivered face-to-face in 25 regions and also via webinars. Hydra Consulting claims that feedback on this program has been excellent, with a net promoter score of over 80.

A net promoter score (NPS) is a metric for assessing customer loyalty for a company's brand, products or services. The NPS is calculated as the difference between the percentage of 'promoters' and 'detractors'. The NPS is not expressed as a percentage but as an absolute number lying between -100 and +100. For instance, if you have 25% promoters, 55% passives and 20% detractors, the NPS will be +5. By way of example, in 2017 Apple had a NPS of 72.

The workshops have reportedly been successful because:

- the program is carefully designed before it starts
- the workshops contain simple messages
- participants learn by doing (they prepare a one-page export plan)
- participants get immediate feedback (not always pleasant), and
- participants walk out of the workshop ready to implement.

Relevance to others

The key features listed above are not only applicable to the Growing Wine Exports workshops, but to extension / adoption activities more generally:

- design the activity carefully up front, in collaboration with the target market
- create a 'promise' from attendance, that is, a clear statement about what participants will gain by the end

- maximise the use of hands-on learning / learning by doing, and
- ensure participants walk out 'ready to implement' the new practice.

Case study 4: Brettanomyces – solving a wine spoilage problem

Overview and summary of impact

Brettanomyces ('Brett') is a yeast that is commonly found in wineries (and breweries). Molecular research by the Australian Wine Research Institute (AWRI) has shown that there are dozens of strains of Brett in Australia. It is found in wine and in barrels and persists through cross-contamination between the two.

Two decades of research and extension by AWRI, with funding from Wine Australia, has substantially reduced the cost to the Australian wine sector of spoilage associated with the presence of the yeast Brettanomyces.

The situation

Brett produces a range of volatile phenol compounds, principally 4-ethylphenol (4EP) and 4-ethylguaiacol (4EG). These compounds can impart undesirable sensory characteristics on wine including 'medicinal', 'leather', 'smoky', 'spicy', 'Band-Aid ™' and 'barnyard'. These expressions depend on the ratio of compounds produced, which is in turn related to the grape variety. Brett is also associated with reduced fruit flavour intensity and a drying, metallic aftertaste. Consumer studies by AWRI indicate that the concentration of Brett compounds in wine is strongly and negatively correlated with consumer liking.

The critical risk period for Brett spoilage is known as the 'Brett zone' – the period between the end of primary and secondary fermentation, and before the addition of sulfur dioxide – especially when residual sugars are available to the yeast. Slow or stuck malolactic ferments increase the risk.

Brett is an international problem, having been described in Bordeaux (France) and the USA, for example. It primarily affects red wines.

Connection with research and extension activities

In 1998/99, researchers at AWRI developed analytical techniques for measuring oak flavours, including 4EP and 4EG. Extensive testing of samples indicated a much higher than expected prevalence of the compounds in Australian wines and therefore of Brett.

With the realisation of the extent of the problem, AWRI commenced a major research program on Brett, mainly between 2001/02 and 2007/08. The aims of the research were to:

- Monitor the prevalence of Brett across Australia
- Determine which wine composition parameters favoured or prevented Brett growth, including sweetness, alcohol, acidity, pH and SO2
- Identify flavour compounds that characterised Brett
- Describe Brett characters in different wine styles, determine threshold levels and consumer-liking
- Understand why wines of some varieties produced more Brett-associated spoilage compounds than others and what the precursor compounds were
- Develop methods to isolate Brett using media (which was reportedly not possible), and
- Collect Brett yeasts from across Australia to determine if all Brett yeast were the same, using new DNA techniques and later using molecular sequencing.

More recent research has focused on genetic characterisation of the yeast and understanding the reasons behind SO2 tolerance in the different strains. Adaptive evolution of the yeast to SO2 has been recently identified which may require future alternate control measures.

Control strategies for Brett have been progressively refined as AWRI researchers have tested ideas and observed outcomes of interventions adopted by wineries, particularly those with significant Brett spoilage issues. The research has produced many spinoffs in other areas of wine quality, such as reductions in the concentrations of volatile acidity and greater expression of fruit, regional or varietal character, involving collaborations with research groups at the University of Adelaide, in Bordeaux, in Chile and elsewhere.

AWRI promotes a strategy comprising eight major planks for Brett control, central to which are sanitation, reducing the duration of malolactic fermentations and smarter use of SO2. AWRI makes this information available in web-based materials including a fact sheet, as well as helpdesk support and a commercial Brett audit service. Seminars and workshops for winemakers have also been an important part of the delivery. Seminars were conducted across Australia in 2002 at the start of the project. Control strategies for Brett were detailed as part of workshops on instabilities and wine faults during 2001-2006, and participants were shown how to isolate Brett from wine and identify it using a microscope. 'Bretty' wines were also tasted so winemakers could identify these better in practice. Brett workshops were delivered at the 2004 and 2007 Australian Wine Industry Technical Conferences. These workshops then became part of ongoing 'Taints' workshops.

The research effort has also led to the development of a range of products and procedures to control Brett, such as reverse osmosis technologies to remove 4EP, quick self-test kits (Veriflow ®) to detect Brett yeast in wine and online calculators for molecular SO2 and nitrogen (YAN).

Details of the impact

A benefit–cost analysis of the Grape and Wine Research & Development Corporation's investment in Brett research and extension between 1999 and 2008, through AWRI, was conducted in 2012 by Econsearch. The study estimated a $42.1 million net present value from the $3.2 million investment using a 5% discount rate. The benefits realised were primarily avoided losses due to downgraded wines ($31.9 million) and reduced winery management costs ($11.0 million).

Evidence of changes in the extent of Brett comes from direct measurement of 4EP in Australian wines. In the mid-2000s, a survey was undertaken in commercially available cabernet sauvignon wines from five regions over nine vintages to 2005. The observation of year-on-year increase in queries about Brett to the AWRI helpdesk leading up to 2018 prompted a repeat of the survey, this time on wines from the 2015 vintage from the same regions.

Data from the two surveys shows that between 1997 and 2015 vintage years, the mean concentration of 4EP in cabernet sauvignon steadily decreased from 1251 to 29 µg/L. Whilst almost no wines were free from detectable 4EP in 1997, over 60% of wines fell into this category in 2015 and no viable Brettanomyces yeasts were isolated from any of the wines.

Indirect evidence for the implementation of control measures to control Brett is available from compositional data on wines submitted to AWRI for analysis since 1984. Between 1984 and 2014, there has been a strong upward trend in the ratio of free to total SO2 in red, white and rosé wines, which suggests that winemakers are using SO2 more effectively and according to the strategies developed by AWRI. Notably, this trend has occurred despite a marked increase in the pH of wines over the same period, which would act to reduce the concentration of the free form of SO2.

Relevance to others

The case study provides an excellent example of pragmatic, problem-focused research. There is evidence of strong adoption of identified solutions, which can probably be attributed to:

- The research and development being undertaken in concert with sector participants
- The development of clear, readily actionable solutions
- The extension of these solutions through multiple channels including workshops, with a strong hands-on component along with the Wine Australia funded helpdesk managed by AWRI, and
- The monitoring and demonstration of progress towards addressing the problem, using real industry data.

6. CONCLUSIONS AND RECOMMENDATIONS

The combination of document review, various survey outputs and widespread industry consultation leads to the following general observations about extension and adoption in the wine sector:

- There are many people striving to improve the industry and passionate about their role in it;
- Extension and adoption are certainly not 'broken' in the wine and winegrape sector, and function no better / no worse than several other industries with which we have been involved;
- There are some excellent extension and adoption activities available;
- There are other areas that could be improved;
- If anything, there has been too great a focus on outputs rather than outcomes and impacts, and this should change;
- Contemporary extension and adoption thinking involves participants in determining the priorities and extension and adoption activities. This could be enhanced in the sector; and
- Wherever possible:
  - Create a promise for participants, and honour that promise;
  - Provide an array of extension and adoption approaches to suit differing learning preferences. That said, use of electronic means (webinars, podcasts) should be increased;
  - Use case study examples showing the clear costs and benefits; and
  - Focus on 'learning by doing / showing', rather than 'learning by saying'.

The following recommendations are made for Wine Australia's consideration:

Strategy

1. Every extension and adoption activity that Wine Australia supports should reflect contemporary best-practice principles from extension, design thinking, social marketing and related disciplines, as summarised in this report. These principles should be clearly enunciated in the extension and adoption strategy and used as guiding principles which all activities should meet.
2. Wine Australia should consider the development of a 'single-source of truth' in relation to viticultural and oenological practices. This could take the form of a web-based best practice manual. Such a manual should be updated with the latest research results as they become available. It is acknowledged that much of this is already available from existing resources (e.g. AWRI, Wine Australia, NSW DPI, PIRSA etc). The aim will be to provide a seamless integrated resource (not necessarily hosted by one organisation) for use by practitioners and advisors.
3. Early engagement of levy-payers (extension and adoption target markets) is crucial. In this regard, Wine Australia should establish a levy-payer based advisory committee to assist AWRI and Wine Australia to identify extension and adoption priorities and plan activities at a national level. The charter of the Australian Grape & Wine Research Advisory Committee could be expanded for this function.

Resources

4. Whilst recognising Wine Australia's restricted budget situation, any additional allocation of resources should be targeted at extension and adoption activities rather than a greater allocation to R&D. In particular, additional resources to the regional program is seen as a priority.

AWRI

5. AWRI should remain an important extension and adoption conduit to the grape and wine sector.
6. The relationship between Wine Australia and AWRI from an extension and adoption perspective needs to be nurtured and be based on mutual trust and understanding. It should operate on a policy of 'no surprises'.
7. In undertaking its activities, AWRI should increasingly engage with other research and extension providers in joint delivery.
8. Key performance indicators (KPIs) in the AWRI and Wine Australia annual operational plans are very output-focused. In future, KPIs should be a combination of outputs and outcomes (SMART objectives – specific, measurable, achievable, realistic and timely). This will also require adjustment to monitoring and evaluation procedures to appropriately capture outcomes.
9. The scope of AWRI's extension and adoption activities should include the following:

    9.1 The design and delivery of extension programs, however:

        9.1.1 The process for activity topic selection and delivery design is inclusive and involves AWRI, Wine Australia, regional associations and other user groups.

        9.1.2 Activities should be demonstrably designed using best practice principles as outlined in the extension and adoption strategy, according to the nature of the topic, the target audience and other relevant factors. In particular, there should be a stronger emphasis on hands-on learning activities and less on 'stand and deliver' formats such as seminars.

        9.1.3 All activities should provide prospective participants with a clear 'promise' that attendance will afford them the ability to implement a particular beneficial practice.

        9.1.4 Seminars are important but should be arranged to maximise time efficiency of presenters and the audience. A strong focus should be given to identifying and utilising more modern formats that offer cost-efficiency and convenience such as webinars or podcasts. Opportunities to adopt such formats should be identified in collaboration with the target audience.

        9.1.5 There should be a more even balance between winemaking and viticultural topics (an expected outcome of 9.1.1).

        9.1.6 The definition of seminars and workshops should be refined and, potentially, the term 'roadshow' should be removed as it is used to refer to other activities in which Wine Australia is involved.

        9.1.7 Participation in Wine Australia marketing events should form a separate activity and reported separately to enhance transparency.

    9.2 Communication with stakeholders:

        9.2.1 This should be focused entirely on extension and adoption activities. Other, 'non-extension' communication activities that are considered important should be redirected into other components of the AWRI–Wine Australia existing plan and renegotiated for the next planning period. For example, the AWRI Annual Report should not be considered an extension tool.

    9.3 AWRI help desk:

9.3.1 The help desk is a service that is valued by the grape and wine sector. No changes are proposed, although greater transparency in the allocation of funds between technical winemaking trials and the use of help desk queries to assist with workshop topic selection, particularly for the regions, is required.

9.4 Library services:

9.4.1 There should be a sharp focus on transforming the library into a modern knowledge hub that searches, sources and curates the latest national and international information into readily-accessible packages for use by the sector. The library is expected to be a principal source of content for the 'single-source of truth' as described in the extension and adoption strategy.

9.5 Regional Program:

9.5.1 As AWRI is or could potentially be a provider of services to the Regional Program, good governance principles require that the program coordinator role be subsumed back into Wine Australia's responsibilities.

10. AWRI should undertake a regular survey to assess the impact of its extension and adoption activities. Such a survey should be undertaken in collaboration with Wine Australia and should cover AWRI session participants and those who have not participated in such events. The focus should be on what practice change has been applied and what factors contributed to adoption, to obtain indicative attribution. The survey should be designed and conducted in close consultation with Wine Australia to ensure it does not duplicate other similar surveys and to maximise its value.

Regions

11. The Regional Program should continue to be supported by Wine Australia. To deliver greater benefits, additional planning resources should be made available to those regions that would benefit from them (either via Wine Australia or from other regions).

12. An annual, one-day meeting at Wine Australia should be made available for regions to gain a full briefing on Wine Australia R&D and marketing activities (potentially using a 'speed dating' format) and to share experiences. The same or a similar event should be made available to sector consultants.

13. Wine Australia should redevelop the regional project template to encourage SMART objectives and clear but simple communication activities and enhanced monitoring and evaluation outcomes of each activity. Such changes should simplify, not complicate, its completion.

14. The recommendations in the AgThentic report are supported by this review. The scope of their implementation will impact on this report. In particular, consideration should be given to supporting AgThentic's recommendations regarding:

    d. The appointment of a Community Technology Manager.

    e. The establishment of a focus vineyard(s) in a regional location(s) to bring together selected technologies (AgTech), solving pertinent local challenges. Activities in central SA, northern SA, Queensland and Loxton to name some, are good examples.

    f. The development of a database of existing technologies (see also Recommendation 2).

15. Wine Australia should develop processes whereby the results of the Regional Program projects can be better shared across the network. This could be via a dedicated web-page, supplemented by half-yearly

teleconferences between regional leaders, AWRI and Wine Australia staff to share experiences (or some sort of online or smartphone sharing platform).

16. The Incubator Initiative should continue. Wherever possible, ease of access should be a consideration.

APPENDIX 1: DOCUMENTS REVIEWED

- AgEconPlus 2018, Benefit–cost analysis of Wine Australia R&D investments 2016–17
- AgThentic 2019, Driving adoption of agrifood technology in the Australian wine industry, final report
- AWRI (Australian Wine Research Institute) 2019, Annual operating plan 2019–20, Wine Australia project
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- Sugar Research Australia 2018, Adoption strategy – planning and investment guide, September

APPENDIX 2: STATUS OF RECOMMENDATIONS OF BAECONOMICS REVIEW

BAEconomics made nine recommendations. These are listed below, along with a response from Wine Australia as to the status of the recommendations made.

	RECOMMENDATION	STATUS
1	That for future years GWRDC considers the following:	
	⌗ Make funding for each activity contingent on the relevant regional body making a contribution to the cost of the function – this could be an in-kind contribution – to help ensure that significant local effort is made to encourage as many participants to attend as possible.	Actioned.
	⌗ Setting strict KPIs against which to measure the value for money from workshops, seminars and roadshows and related activities including participant feedback surveys with data provided to GWRDC and setting target participant numbers; and	Not actioned, topics continued to be selected without direct GWRDC (Wine Australia) involvement.
	⌗ Determine topics jointly with AWRI and the relevant regional body, select the topics that are most relevant to the particular region and limit the number of topics to ensure that presenters are properly focussed on the event; and	Not actioned. Considered that regional bodies are already making an in-kind contribution.
2	That GWRDC considers the future workshop and seminar program in parallel with the proposed roadshow program to ensure that topic coverage is coordinated, and that regional coverage is at least partially consistent with levy contributions. At the same time attention should be paid to ensuring that funding is available in establishing regions particularly as growers adapt to any climate change.	Not actioned, AWRI continued to develop workshop program based on perceived emerging issues and run separate roadshow program, with overlap avoided organically. Coordination between the two not a major focus. GWRDC advised of decision, not involved in decisions.
3	That GWRDC considers increasing funding of extension activities that are directly targeted at grapegrowers.	Actioned. Factsheet and resource development focused more on viticulture and viticultural content in AWRI extension activities was increased.

	RECOMMENDATION	STATUS
GWRDC Regional Program		
4	That, in order to ensure effective use of the Regional Program funds, GWRDC considers stipulating that the relevant regional body contribute $1 for every $4 contributed by GWRDC for program activities. The contribution from the regional body could be 'in-kind' at the discretion of GWRDC. Emphasis should be placed on organised field days and field trials as a means of extending information but there will need to be an on-going commitment to field trials if these are to be successful.	Not actioned in full. An in-kind contribution would be the default response and it would be difficult to ensure compliance. It was considered that this would likely result in loss of goodwill, administrative burden but no actual practice change. Instead, GWRDC implemented 6 monthly Regional Partners meetings and additional support for our Regional Partners in developing, running and evaluating the success of their activities.
GWRDC media and communications		
5	That as a part of the redevelopment of the GWRDC website, GWRDC considers establishing its website as the central industry web portal for the distribution of wine and grape growing research and extension information.	Actioned in part. The new website was more clearly organised, and additional on-line resources were developed and included. The central industry web portal concept was not pursued.
AWRI nodes		
6	That GWRDC maintain funding to the Victoria node on the current basis and enter into discussions with state departments and other organisations as relevant to establish other 'extension' partnerships. Such partnerships should be jointly funded by the relevant state department and others (if applicable) where the primary focus is extension and the partnership performs an identifiable extension function. Support for the Riverina, Hunter and Tasmania nodes should be discontinued from 2014–15 unless they can be re-configured on the recommended basis.	Actioned. Riverina, Hunter and Tasmania nodes discontinued.
Technical reviews and factsheets		
7	That technical reviews and factsheets be edited by authors with appropriate written communication training and that all such material be available on the industry web portal (Recommendation 5).	Actioned. Resources available on GWRDC and/or AWRI websites. The central industry web portal concept was not pursued.
AWRI social media and electronic extension products		
8	That careful consideration be given to the level and type of support for the development of electronic extension products and in particular that:	

	RECOMMENDATION	STATUS
	⌗ Any organisation funded to produce electronic extension products be required to provide training in written communications skills for authors of those products; and	Actioned in part. Twitter continued to be one of the social media platforms utilised by AWRI.
	⌗ No financial support be provided to third parties for activities that are largely aimed at 'branding' such as Twitter.	
John Fornachon Memorial Library		
9	That the funding for the John Fornachon Memorial Library be maintained and that AWRI be requested to better inform industry participants of the services available from the library and actively promote its use.	Actioned.

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