

PRIME MINISTER'S SCIENCE, ENGINEERING AND INNOVATION COUNCIL

FOURTH MEETING - 26 NOVEMBER 1999

AGENDA ITEM 2

THE AUSTRALIAN WINE INDUSTRY – SUCCESS THROUGH INDUSTRY LEADERSHIP, PLANNING AND INNOVATION.

EXECUTIVE SUMMARY

The Australian wine industry's continuing growth in exports over the last decade has been impressive and is illustrated by a compounding growth rate of 15% per annum in volume and more than 20% per year in value¹. In the mid 1980s, we were net importers of wine but now export 30% of the total production. Australian production represents 2.3%¹ of the world market by volume and 4.8%¹ by value with almost 40% of Australia's ca 1100 wineries figuring as exporters. The wine industry generates about 60,000 jobs, in excess of 600 million dollars in wine tax revenue and is one of few sectors creating wealth, regional employment and growth opportunities in many of Australia's otherwise economically depressed areas². Projections for further growth indicate the capacity to almost double export revenues by 2003, with modest increases in domestic consumption³.

An analysis of the reasons for this success is imperative as it may give pointers to successful strategies for other export industries.

Many factors have contributed to export growth. Of crucial importance, and outside the industry's sphere of influence, has been favourable long-term depreciations of the Australian dollar. Industry rationalisation leading to critical mass of organisations and economies of scale have been crucial. Equally important, however, has been the transformation of grapes and wine into a value-added knowledge-based product with inputs from education, research, production and marketing, supplemented by continuous benchmarking and technology transfer. Research and education with an industry focus have been indispensable for the establishment of a 'learning culture in pursuit of excellence'. Together, they have fertilised a continuous innovative streak in industry practice, a streak which can be considered catalytic and self-enforcing once the innovative path has been instigated. A tangible outcome of this knowledge-based change is an overall shift from production of non-premium to purpose-built wine in response to an autonomous consumer shift towards premium wine consumption.

The Australian wine industry's current success is, to a large extent, built on the technical ability to respond to the world consumers' sentiments and deliver products at a superior quality/price ratio,

¹ Anderson, K and Berger, N "Australia's Re-Emergence as a Wine Exporter: The First Decade in International Perspective". CIES Wine Policy Brief No 5, October 1999.

² Winemakers' Federation of Australia (1988) "A New Tax System and a New Tax: Impact on the Australian Wine Industry" May 1988.

³ Outlook 99, Proceedings of the National Agricultural and Resources Outlook Conference, Canberra, 17-18 March 1999, Vol 2.

presented in consumer-friendly packaging. In other words, Australia's approach has been to listen to the consumer's desires and strive to meet those through application of innovation. The single most important distinguishing factor of the wine industry in regard to innovation has been its ability to vertically and fully integrate research, education and technology diffusion, as a culture in synergy with business and marketing principles. This effort, eloquently expressed in the industry's 2025 strategy, has been driven by collective industry planning, in which a multi-faceted and reciprocal partnership between industry, researchers and educators has evolved and in which the complementary roles of individuals and agencies have been clearly defined.

Innovations have comprised both quantum leaps (e.g. introduction of mechanical harvesting and pruning by CSIRO), continual improvements (e.g. gradual reduction in wine spoilage compounds through improved practices promoted by The Australian Wine Research Institute, and planting to premium grape varieties), and a sound level of education promoted by educational institutions and extension efforts by State Departments of Agriculture.

Central to all the innovative efforts in the wine industry has been a combination of collaboration and competition. These efforts are characterised by a sharing of professional user-pays industry structures which ensure the formation of collective views and collective actions, including a pre-competitive sharing of enabling research outcomes and their costs

The pre-competitive sharing of efforts to build and protect the wine brand 'Australia', has allowed charismatic and visionary industry leaders to share the burden of guiding the research, technology diffusion and education agendas either through their 'own' research provider or through interaction with government instrumentalities prepared to take up the issues defined by industry as crucial to future sustained growth. In all instances, the wine industry has been keen to collaborate with researchers to evaluate quickly the outcomes of new research, a feature which has been reinforced by the guiding initiatives of industry peak bodies and the Grape and Wine Research and Development Corporation.

The transformation of the wine industry into a knowledge-based and innovative industry represents a prime example of closing the gap between the science and its application. The working group considers that the example set by the wine industry can be implemented by other, similar industries.

Recommendation 1:

Industries should review, establish and manage pre-competitive sharing of user-pays industry programs and structures for the benefit of building and maintaining the integrity of "Brand Australia" where appropriate. The concept of building a credible brand 'Australia' should be backed by technology and expanded across industries with complementary products, for example wine, food and tourism, as the performance of the brand in one sector can affect the brand in another sector.

Recommendation 2:

Using the mechanisms to form collective views and actions, industries should with Government encouragement formulate strategies for their further development. Such strategies, which ideally would have a time horizon of approximately 20 years, should integrate production, innovation, marketing, competitor analysis and market opportunities and furthermore identify the requirements for Government to provide a positive investment climate and to facilitate infrastructure development.

This paper was prepared by an independent working group for PMSEIC. Its views are those of the Working Group, not necessarily those of the Commonwealth.

Recommendation 3:

Government, industry and institutions must, through appropriate reference groups, critically review the best approach to deliver optimal education for students wishing to enter defined target (primary) industries and professions. Specifically, the issue of facilitating cross-institutional provision, postgraduate coursework attendance, industry participation and non-traditional modes of delivery should be investigated. The review must also consider how the flow of PhD trained personnel into primary industries can be accelerated through improving the attractiveness of PhD graduates to industry. This may initially involve a funded facilitation scheme.

Recommendation 4:

Government, industries and research providers should identify mechanisms to form long-term links between researchers and target industries both in relation to identification of research needs and the implementation of research results to provide commercial outcomes. Such mechanisms include promotions criteria, funded staff exchange, intellectual property rights and industry reference groups. The short-term nature of some research grants is not conducive to planning and building of lasting relations between research providers and industry. Provision should be made to introduce longer funding cycles to research providers/industry partners with a good track record and to further strengthen research through the Rural R&D Corporations and Cooperative Research Centres.

Recommendation 5:

Research agencies and Industry must enhance existing schemes, and where necessary develop new schemes, to ensure that Australian Industries have access to the total pool of global innovation through benchmarking, exchange schemes and formation of funded international links.

Recommendation 6:

Government must continue to recognise that basic research is fundamental in a knowledge driven economy. Institutions must however demonstrate that their researchers and educators have an understanding of the path to application of research outcomes and integrate such knowledge into the training of their graduates. Specifically it is recommended that all PhD programs must include components that familiarise the students with the essential steps to and satisfaction to be gained from bridging the gap between the science and its application.

Recommendation 7:

In recognition of the increasingly multi-disciplinary nature of research and development as well as the cost-effectiveness of sharing resources; Governments must strongly encourage the development of research clusters and the development of shared visions and plans for such clusters. Industry specific research Institutes, should almost certainly be co-located with other research and educational providers.

1. AUSTRALIAN WINE EXPORTS: A SUCCESS STORY WHICH ENHANCES REGIONAL DEVELOPMENT AND THE AWARENESS OF OUR COUNTRY

The Australian wine industry's phenomenal continuing growth in exports over the last decade is illustrated by a compounding growth rate of 15% per annum in volume and at least 20% per year in value. This compares well with a 6.5%³ compounding growth in total world wine exports in the same period. In the mid 1980s, Australia was a net importer of wine, but now exports more than 30% of its total production. The volume of imported wine is about 13% of the volume exported, and primarily serves to overcome shortages induced by enhanced exports combined with seasonal variability. Almost 40% of Australia's more than 1100 winemakers are exporters. Such a high degree of export participation is generally only found in the pharmaceutical and scientific equipment sectors, compared to the export participation rate of less than 10% which applies to the manufacturing sector as a whole. The growth trend for Australian wine exports, compared to the mixed performance of other commodities, is shown in the graph at Attachment A.

1.1 'The Australian wine industry is punching above its weight' and has ample scope for growth

Australia currently supplies only about 2.3%¹ of the volume of the world's wine production (increased from about 1.5% a decade ago), but is responsible for greater than 4%¹ of the value of global exports (rising from 0.9% a decade ago). The main export markets are the UK (47%), North America (26%), New Zealand (6%), rest of EU (10%) and Asia (5%). Encouragingly, the price per litre received from Australian export wine in the UK (\$4.58/L for 216.2 million litres in 1998/99) is the second highest, following New Zealand wine.

It is an ambition of the wine industry to not only greatly enhance export volumes but also, increasingly, to populate the premium and more profitable segments of the international market. It is evident that exports of Australian wine still can grow substantially without the need to capture a very large share of world production and exports.

Australia has the credentials to achieve this – we are also punching above our weight in the 'wine-olympics'. At the 1997 International Wine Challenge in London, Australia won 42 of 148 gold medals compared with France's 25. Similarly, at the 1999 International Wine Challenge, Australia won 58 gold medals compared with France's 39 gold medals. Australia won one medal for every 19 entries whilst France won one for every 54 entries.

1.2 Successful export growth has substantial benefits to regional Australia

The 1995 report of the Industry Commission's inquiry into the Winegrape and Wine Industry considers the benefits of export growth in extended detail. In addition to the economic benefits outlined below, the presence of the wine industry in regions also has wider social implications. For example, submissions to the inquiry noted that:

The winemakers from the small wineries often provide the leadership required for regional projects and development... In the Barossa, Riverland and Southern Vales,

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the local winemakers have been instrumental in developing the strategies that provide for retention of the rural environment and aid in further regional development.

and

The Warren Valley Region has been historically dependent on the timber industry for employment ... the wine industry broadens the horticultural base of the area thus increasing its economic stability.'

1.2.1 Investment in vineyards and wineries

The unprecedented growth in grape and wine production, and expectations of further export success, have resulted in massive expansions in the industry with the area planted to grapes growing from ca 60,000 ha in 1995 to about 100,000 ha in 1999. There are few signs of a decline in the rate of growth. The cost of vineyard establishment, excluding land costs, is close to \$30,000/ha. This means that in excess of \$1.2 billion has been invested in establishment of vineyards, with a similar amount set aside for processing and winery equipment. These investments take place in rural areas across Australia, with substantial flow-on benefits to regional economies.

A specific example is the Langhorne Creek area of South Australia, where the vineyard area has expanded from ca 400 ha in 1990 to approximately 3800 ha this year, a total investment of \$100 million in the past five years alone (see Attachment B). Optimistic projections further indicate that the wine export contribution of South Australia alone is likely to increase from \$635 million in 1998-99 to well in excess of \$1 billion in 2003-2004. Such an expected expansion is also reflected in further construction of wineries and tourist resorts in the regions. For example Mildara Blass has initiated construction of a \$75 million facility near Tanunda.

1.2.2 Employment

According to the 1996 Census, there were almost 16,000 Australians employed in 1,000 wineries and 50 grape growing regions throughout Australia. This is a 60% increase over the census figures of 1991. Considerable further growth has occurred since 1996. In addition, it is estimated that casual and part-time employment adds a further 3,500 full-time equivalent jobs. It is estimated that an additional 40,000 jobs are generated in support industries such as wholesaling, retailing, transport, research, education services, packaging and tourism².

1.2.3 Tourism

Every day, over 700,000 bottles of wine carrying the name 'Australia' are opened and enjoyed by more than 1 million people overseas. The high quality of Australian wine products reflects well on other Australian products, and generates additional tourism valued at \$500 million per annum. A National Wine Tourism Strategy has been developed and it is envisaged that by 2008, wine tourism in Australia will be worth \$1.5 billion annually.

1.2.4 The wine industry value adds

The wine industry takes \$800 million in grapes and turns them into \$3 billion worth of wine in wholesale sales. This generates export revenue of \$1 billion and a domestic wine tax revenue of over \$600 million, additional to company taxes and employee personal taxes.

1.2.5 Investors have confidence

At the beginning of 1990, there were three wine companies listed on the Australian Stock Exchange, whereas we now have 17 listed companies, not including major companies which are either privately owned or not separately listed. Since the release of the industry's *Strategy 2025* document in 1995, wine companies have strongly out-performed the All Ordinaries and Industrial indices, with market capitalisation growing from about \$1 billion in 1992 to \$4 billion in 1999.

2. THE WINE EXPORT BOOM – THE ENABLING FACTORS

It is clear that the factors underlying the industry's success are of two types: those outside the industry's control – such as exchange rates – and those under the industry's control – such as rationalisation and commitment to collaboration, research and innovation.

2.1 Factors outside the industry's control

2.1.1 Exchange rates

Following the depreciation of the dollar in the mid 1980s and again in the late 1990s, exchange rates have further enhanced the competitive edge of Australian wine in the export markets. However, while this has been most important, the benefits of lower exchange rates apply to all export industries. Not all of these have done equally well.

2.1.2 Specific events

The Chernobyl disaster in 1986, and the reluctance of many Northern European countries to consume potentially contaminated agricultural produce, generated a short window of opportunity which alert industries, including the Australian wine industry, capitalised on to establish footholds in foreign markets at a time when exchange rates were moving in a favourable direction.

2.1.3 Climatic factors and availability of land.

Australia is a premium wine grape growing area, able to grow grapes for a variety of wine styles and types with very low disease pressure and, therefore, an ability to apply low degrees of spraying. This not only allows us to produce for a large variety of niche markets but also to promote the 'Clean and Green' image credibly. While water availability is an issue, this can be addressed through enhanced efficiencies, in concert with rational water pricing and other environmental factors such as pesticide use.

There are large tracts of suitable land available for viticulture in Australia, and expansion of grape growing is still relatively cheap. Land shortage is unlikely to become a limiting factor in the next 25 years.

2.2 Factors under industry control

2.2.1 The ability to generate collective views and instigate collective action.

A feature which is not unique to, but certainly highly developed in, the Australian wine industry, has been the realisation that collaboration and unity, combined with a sense of a common purpose, is a

vital base upon which successes beyond the scope of individual firms is built. As a result, a cohesive and holistic approach to industry development has been embraced. In this scenario, a pre-competitive sharing of otherwise impossible tasks has been fulfilled prior to entry into a common export market where the main competitor has been identified, not as fellow Australian exporters, but rather as the dominant ‘Old World’ producers. The pre-competitive sharing has had one aim: ***building and protecting the “Brand Australia”***, through the mechanism of ***development of industry engagement, unity and self-reliance***. In simple terms, the industry has collectively funded infrastructure development for the companies to ‘piggy-back’ their brand promotions. The pay-back has been the development of “Brand Australia”. The industry’s adoption of universal guidelines to minimise the use of agrochemicals through effective communication with its grower base is one such example of a through-chain approach to product manufacture and marketing.

The wine industry now has in place largely self-funded structures to promote its causes and plan its achievements. Importantly, some of these structures are funded to carry out duties which traditionally would have been expected to be in the domain of Government alone. The organisations that currently enable the formation of collective views are The Winemakers’ Federation of Australia and The Winegrape Growers Council of Australia whilst two bodies instrumental to collective action are The Australian Wine and Brandy Corporation and The Grape and Wine Research and Development Corporation. Details of these bodies, mostly based on industry levies, are presented in Attachment C.

Finding: The wine industry has put in place structures ensuring the formation of collective views and collective action. This has been achieved through robust ‘user-pays’ structures which seek to build and protect the brand-name Australia. The industry is dependent on a partnership with Government in which statutory regulations provide an environment which dictates the further development and protection of “Brand Australia”. This further development of a credible “Brand Australia” will be dependent on technology and a culture of learning and experimentation. It is recognised that not all types of products lend themselves to the “Brand Australia” concept. Importantly, “Brand Australia” promotion should facilitate, not hinder or replace, companies’ own brand promotion.

A strong sense of “how can we do it better?” rather than “that’s the way its done” exists in the Australian wine industry. While heritage is important to the marketing of its products, the Australian industry does not tend to embody heritage in the way wine is made. In fact, a “heritage of innovation” has become a point of differentiation for Australian wine.

Recommendation 1: Industries should review, establish and manage pre-competitive sharing of user-pays industry programs and structures where appropriate for the benefit of building and maintaining the integrity of “Brand Australia”. The concept of building a credible brand ‘Australia’ should be backed by technology and expanded across industries with complementary products, for example wine, food and tourism, as the performance of the brand in one sector can affect the brand in another sector.

2.2.1.1 Unified industry planning: development and implementation of *Strategy 2025*

There are other examples of the integrated approach to industry development which is characteristic of the wine industry, but none more so than the development of the industry plan, *Strategy 2025*. This plan, published in 1996, presents a bold vision and directions to achieve \$4.5 billion in annual sales, and to become the world's most influential and profitable supplier of branded wines, pioneering wine as a universal first choice lifestyle beverage. The plan contains a clear objective to entrench innovation as the driver of industry competitive advantage.

The supporting strategies for this objective are:

- Increase R&D effort and application to the priorities of the quality and specification improvement, cost reduction and supply improvement.
- Further develop the existing wine industry “learning” culture of innovation and co-operation to compete.
- Benchmark industry production and management processes to assure world best practice.
- Accelerate the adoption of environmentally sustainable policies and practices in all aspects of the industry.
- Maintain the existing minimal regulation to ensure market responsiveness and production flexibility.

Development and effective pursuit of *Strategy 2025* could not have been achieved without industry unity. The inclusive nature of the consultation process has meant that virtually all sectors of the industry have ownership of the plan and therefore take pride in achieving the stated mission which requires the overlapping skills of many different disciplines. The wine industry has attracted such people from many sectors of the Australian work-force. The emergence of the leadership of the Winemaker's Federation of Australia has been a key factor in the development of a universally endorsed forward direction.

The plan was viewed by many as too optimistic, but now, three years after its release, it is clear that all of industry has taken the challenge seriously, and now finds itself well ahead of performance goals. The plan is a living one and reference is made to it on a continuous basis with reviews being undertaken at all times at industry meetings and in print. It is suggested that a similar, unified strategic approach by other industries could enhance their collective competitiveness in the international market place.

Finding: The unified nature of the Australian wine industry has allowed it to develop a comprehensive plan for growth in which a high degree of ownership has developed collective action. This plan is a main source of envy and the unlikelihood of being able to implement similar strategies in other countries, due to the lack of industry unity, will remain a competitive advantage. The availability of a plan, with innovation as its distinct focus, means that the focus of the industry is retained even when personnel changes.

Recommendation 2: Using the mechanisms to form collective views and actions, industries should with Government encouragement formulate strategies for their further development. Such strategies, which ideally would have a time horizon of approximately 20 years, should integrate production, innovation, marketing, competitor analysis and market opportunities, and further identify the requirements for Government to provide a positive investment climate and to facilitate infrastructure development.

2.2.1.2 Industry-Government interactions: The EU agreement on trade in wine

Australia has, in the view of the rest of the ‘New World’ wine producers, achieved an enviable access to the EC market through the negotiation of the EC/Australia Wine Agreement. Negotiations started in April 1988 and were signed in January 1994 with effect from March 1994. The ongoing negotiations, initiated by the Australian wine industry and supported by Government, are a prime example of industry vision and initiative. The industry has not restricted its activities in this area to the EU agreement, and has developed a strong strategic partnership with government in regard to trade and regulatory issues.

3 **THREE CRITICAL ELEMENTS OF INNOVATION – ALL MASTERED BY THE WINE INDUSTRY**

3.1 **Integrating Innovation into the Industry**

In submitting its bold vision for annual sales of \$4.5 billion by 2025 in the *Strategy 2025* document, the Australian wine industry adopted the mission statement: **‘Total commitment to innovation and style from vine to palate.’** It is envisaged that a main driver for this goal is a commitment to increased research and development, and to further develop the existing wine industry learning culture. These commitments, in turn, define **three critical elements for industry innovation:**

1. An enhanced commitment to R&D through increased financial contributions and industry participation;
2. An enhanced effort to secure technology diffusion through communication of research issues to industry; and
3. An enhanced ability of the work-force to receive and critically evaluate increasingly sophisticated technical issues.

Without appropriate research funding, new knowledge is not generated and, without continual industry input, the right research will not be performed. Second, without communication, even the most useful R&D outcomes remain meaningless. Finally, without an educated work force, even the best research and communication strategy is inconsequential. On the first issue it is, therefore, pleasing to see that the peak bodies of the wine industry, collectively recommended that the combined grape and wine levies be increased from \$3 per tonne to \$5 per tonne with effect from the 1999 vintage. This levy will be administered through the GWRDC. It is critical that government continues its matching funding of industry levies to entrench innovation and further enhance industry competitiveness.

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In regard to the second issue, many Australian researchers have contributed to the generation of a large and varied, but importantly quite accessible, literature in the form of books, seminar proceedings, and journal contributions. Likewise, many Australian researchers have contributed to facilitating the diffusion of information through 'road shows', field days, Australian Society of Viticulture and Oenology (ASVO) seminars, Research to Practice™ Programs (see below), technical conferences and other forms of information provision. For example, the Australian Wine Research Institute has, since 1970, organised a large, triennial technical conference with full published proceedings (see enclosed CD-ROM). Similarly, the *Australian Journal of Grape and Wine Research*, established in 1995, is provided to every member of ASVO.

Whilst the Australian wine industry most likely possesses a better qualified work force than most, if not all, of our competitors – and whilst a sustained interest in Grape and Wine Studies at TAFE and university level is evident – there is scope to do better in this category. According to recent ABS figures, the 1996 census identified 7,420 people whose main job was in grape growing, and 8,328 people whose main job was in the manufacturing or blending of wine. Educational qualifications were less common among workers in both the grape growing and wine manufacturing industries than the average across all industries. Clearly there is scope for employment of more personnel with degrees and postgraduate qualification. It should be considered how industries in general can be encouraged to employ more PhD educated personnel. Although the SPIRT and CRC Schemes are helpful in this regard, more needs to be done.

The availability of appropriate educational providers is an important issue. The Australian wine industry has been fortunate to have been served, for a very long time, by two institutions providing tertiary education in the area of viticulture and oenology. The fact that most winemakers and viticulturists in Australia have come through one of two Institutions may have enhanced the development of the culture of pre-competitive sharing of efforts to strengthen the industry as a whole. Some important attributes of the current educational bodies differ significantly from many 'old world' producers:

- The courses encourage students to look outwards, to taste wines from around the world and learn how they are made. Traditional training in the Old World is regionalised, training winemakers in only the practices and styles of one area.
- The training and education has a strong scientific base, encouraging students to challenge practices with confidence and experiment with new ideas.
- There are very strong links between the educational institutions and industry, promoting the transfer of real and current applied knowledge and information to students.
- The institutions are involved strongly in industry research programs, giving students access to leading edge information.

The success of the wine industry has, in this period of competition for students in tertiary education institutions, led to a myriad of new courses being offered across the country. The wisdom of these developments must be questioned, as many of the providers of teaching in viticulture and oenology have a short track record, and as the investment in infrastructure required to mount these teaching programs is very high whilst the critical mass of experts may not be achieved in many instances. An alternative approach would be to identify the expert providers, and facilitate the migration of students

towards these providers without unnecessary national duplication. These changes could be based on the instigation of degrees across institutions, or on distance education programs.

A third and very attractive educational opportunity is to facilitate the access to fee-paying postgraduate course-work programs.

Findings: The wine industry has been well served by two key providers of education and very strong links with industry is evident both in teaching and research efforts. The CRC program has also helped produce high-quality postgraduates. A free-market approach to the establishment of additional courses will undoubtedly suffer from the lack of critical mass in some instances and diminish industry's ability to interact/contribute/ influence education outcomes effectively. It is considered that the interaction of the educators with industry will introduce an application and innovation focus to the educational outcomes, and also ensure that employees can receive skills upgrades in a timely fashion. As a fundamental prerequisite, industry must be encouraged to more actively participate in the education process to secure a suitably qualified work force. In the longer term, industry will suffer from the lack of a coordinated approach to education and training

Recommendation 3: Government, industry and institutions must, through appropriate reference groups, critically review the best approach to deliver optimal education for students wishing to enter defined target (primary) industries and professions. Specifically, the issue of facilitating cross-institutional provision, postgraduate coursework attendance, industry participation and non-traditional modes of delivery should be investigated. The review must also consider how the flow of PhD trained personnel into primary industries can be accelerated through improving the attractiveness of PhD graduates to industry. This may initially involve a funded facilitation scheme.⁴

3.2 The research outcomes

The transformation of practices within the wine industry over the last 30 years is a result of a handful of quantum leaps and numerous small increments in knowledge and practices, which together constitute a large cumulative effect. Some specific examples of R&D outcomes are:

- mechanised viticulture, including mechanical harvesting and pruning, trellis and canopy manipulation, and vineyard floor manipulation
- irrigation practices, including drip irrigation (regulated deficit and partial root zone drying), and monitoring
- Specifications, including soil analysis and uniformity, maturity sampling and harvest timing, and DNA typing

⁴ The recent higher education research and research training Green Paper, *New Knowledge, New Opportunities*, (p 10) has noted that “(research) training ... is too narrow and limiting in its specialisation; poorly supervised; and out of line with the needs and expectations of employers.”

- Pest management, including integrated pest management, minimal use of chemicals, and phylloxera control
- Controlled winemaking practices, including use of stainless steel, control of temperature, oxidation, microbes, taints, and production of clean marc spirit
- Chemical methods of grape and wine analysis for protein and other instabilities; colour and grape flavour potential; spray residues; and cork taint and oak wood flavour

Other advances have included: identification of wine corks as contributors to random oxidation of bottled wine; identification of protein hazes/bottle deposits and methods to predict and avoid such instability; identification of contaminants/off flavours in wine and solutions to avoid such taints; knowledge of the effects of pH and SO₂ on colour of red wine pigments; and use of enzymes in winemaking.

3.2.1 The case studies

3.2.1.1 Industry participation and leadership

Apart from the manifestation of industry initiative through WFA, WGCA, and AWBC, the willingness of the industry to influence and, in some cases, lead formulation of research can be illustrated with two examples, namely The Australian Wine Research Institute and the Viticulture 2000 bid group.

The Australian Wine Research Institute: the Institute is led by a Council of Directors comprising six industry members nominated and elected by wine levy payers, and four *ex officio* members, mainly researchers. Through the direction of Council, researchers receive strong guidance and a firm understanding of the commercial imperatives which relate to their target industry. Conversely, Council members' pride in their Institute make them strong advocates for continual experimentation and technology utilisation.

The Viticulture 2000 bid group: the Australian wine industry successfully bid for a Cooperative Research Centre in 1991. The CRC scheme was seen by the industry as a successful venture, although widely held views indicated that further benefits could be extracted from the CRC concept, if industry exerted enhanced leadership. As a consequence, the Viticulture 2000 group, comprising notable wine industry leaders, was constituted to lead the bid for a new CRC. Over a two-year period, the group comprising more than 30 industry executives and practitioners performed industry-wide surveys to establish the gaps in knowledge and areas of research priority. Having defined the research priorities, the Viticulture 2000 group then called for research providers to formulate programs aimed at achieving the sought outcomes. Linked to this successful bid process, was a realisation that industry had to contribute more cash towards the CRC initiative and consequently lobbying for a levy increase commenced. The levy was increased and the presentation to the CRC interviewing panel was spear-headed by three industry leaders. The rest is now history: a levy increase was implemented, a total cash contribution from GWRDC of \$2,500,000 per annum agreed to, and an industry dominated board put in place with a former Lindeman's CEO as chair of the second CRC for Viticulture.

Other providers of research and development efforts, including CSIRO Plant Industry (Horticulture unit) and the State Departments of Agriculture have also established particularly good communication relationships with the wine industry encompassing frequent consultations.

Finding: The interaction between the wine industry and researchers in Australia is very strong and almost certainly a main driver for successful innovation. There is a sense of common purpose and the realisation by researchers, that relevant research outcomes are the drivers for industry's willingness to enhance R&D levies, creates a win-win situation. In this regard, the presence of strong strategically focussed industry organisations such as the Winemakers' Federation of Australia is crucial to sustain the industry's R&D push. Evaluation and funding of industry-linked research in the wine industry typically incorporates a credible and real 'two-way' technology diffusion path and should seek to be both informed and endorsed by industry priority reference groups. Even better outcomes would be ensured if barriers to interaction between researchers and industry are removed whilst facilitating structures should be put in place⁵. Furthermore, government must recognise that market failure frequently exists with respect to industry R&D. This is evident in the wine industry with its many small operators combined with the high risk and high costs of some research areas. A case is made for sustained government investment in R&D in the long term. The example set by the GWRDC, which linked its R&D planning to industry planning, is laudable.

Recommendation 4: Government, industries and research providers should identify mechanisms to form long-term links between researchers and target industries both in relation to identification of research needs and the implementation of research results to provide commercial outcomes. Such mechanisms include promotions criteria, funded staff exchange, intellectual property rights and industry reference groups. The short-term nature of some research grants is not conducive to planning and building of lasting relations between research providers and industry. Provision should be made to introduce longer funding cycles to research providers/industry partners with a good track record and to further strengthen research through the Rural R&D Corporations and Cooperative Research Centres.

3.2.1.2 Quantum leap 1: Adoption of overseas developments and rapid introduction to Australia

The introduction of mechanical harvesting. The productivity in Australian vineyards has increased steadily over the past century. The yield per hectare has typically increased eight-fold over the last century and approximately doubled in the past 30 years. This increase in production has only been possible through research into and adoption of new trellis and irrigation systems, higher yielding

⁵ The higher education research and research training Green Paper (p 9) has noted that "More needs to be done to bring the providers and users of research together: To involve users more effectively in contributing their knowledge and experience to the research agenda."

clones as well as an increasing mechanisation of the vineyard operations to make production more cost effective.

Following early experimentation on development of mechanical harvesters in New York State, CSIRO imported experimental harvesters for evaluation in 1969. Today, 80% of all vineyards are harvested by machine with a saving of about \$70-80 million pa to the industry. Apart from the saving to the industry in cash terms, the mechanisation allows harvesting around the clock, harvesting at optimal berry ripeness and optimal temperatures, and viticulture in areas of scarce labour supply. The introduction of mechanical harvesting has been one of the most important developments in Australian viticulture and is an example of the importance of international ‘collaboration’ and awareness as well as an example of a responsive industry.

A logical extension of the adoption of mechanical harvesting, was the CSIRO led development of mechanical and minimal pruning techniques which annually generate an additional saving of \$30 million to the industry. The development of the mechanical pruning, could be seen as an example of a catalytic effect, whereby the innovative streak becomes self-enforcing once the decision to be in innovation mode has been implemented.

Finding: Innovation is a global phenomenon. Australian winemakers and viticulturists travel widely, ensuring that ideas are “harvested” from all over the globe. Industry personnel are also avid readers of the literature, often applying new knowledge from overseas before it is adopted in the country in which it originated. Mechanisms to capture overseas innovation and evaluation in an Australian context must be developed and encouraged. ‘Copying’ and evaluating known principles can be a particularly rapid and relatively cheap way to innovation and economic growth. Restrictive criteria for funding of research and development activities will often prevent funding for such ‘ordinary’ activities to flow through⁶.

Recommendation 5: Research agencies and industry must enhance existing schemes, and where necessary develop new schemes, to ensure that Australian industries have access to the total pool of global innovation through benchmarking, exchange schemes and formation of funded international links.

3.2.1.3 Quantum leap 2: Development of new technology from first principles and basic research in Australia.

Example 1: Partial root-zone drying. Australia is a dry continent and the availability of irrigation technology has underpinned contemporary agriculture and horticulture. Water of high quality is a very scarce resource and, as a nation, the allocation of water for production purposes must in the longer term be guided strongly by sustainability considerations, with a strong reference to the economic returns per megalitre of water used. Growing of premium wine grapes offer one of the best investments of water use from an economic point of view (Table 1).

⁶ The higher education research Green Paper notes that “International networks are particularly important for a country of Australia’s size and location if we are to gain access to the great bulk of research which is conducted offshore.”

Table 1. Commodity Water Usages

Commodity	Rice	Dairy	Sugar	Cotton	Grapes	Vegetables	Wine [#]
value /ML	\$70	\$110	\$240	\$260	\$530	\$610	\$2000

[#]In general, the transformation of grapes into wine multiplies the value about 4 fold on average – for premium wine grapes this figure would be much larger, and could readily reach \$5000.

Australia has witnessed a continuous improvement in our viticultural irrigation techniques with more and more vineyards discontinuing furrow and overhead irrigation in favour of advanced drip and sub-surface irrigation combined with mulching.

An exciting development based on basic research on plant hormone responses in drought situations has allowed the development of an irrigation technique called **partial root-zone drying** (PRD). It is considered that this technology which has been supported by the GWRDC and developed for viticulture principally by CSIRO and the University of Adelaide researchers with input from the South Australian Research and Development Institute during the adoption phase, might revolutionise irrigated horticulture and viticulture. The technique basically involves the systematic watering and droughting of alternate sides of a row of vines. This allows for use of only 50% of the original irrigation volume and ‘tricks’ the vine into a hormonal drought response that suppresses plant vigour (= less shoot and leaf growth) and, therefore, allows better light penetration into the vine canopy. Such conditions, in turn, gives better fruit quality and less disease pressure due to reduction of humidity. The technology has now been applied experimentally for three years and there appears to be no adverse effect on fruit yield and quality, while irrigation requirements have been halved. The adoption of this new technology by the wine industry has been extraordinarily fast, with large areas of vineyards now converted to this irrigation technology. The rapid uptake of this technology is a characteristic of the vine industry –a manifestation of the ‘learning culture’ which now is a way of life in the industry and a cornerstone of its success. A natural extension of this research is now to appoint industry development officers who will facilitate implementation of the technology where it is appropriate. It is exceedingly important to note that the rapid development of this technology was accelerated by the University of Adelaide and CSIRO being clustered on the same campus.

Example 2: Defining the pH problem of Australian red wine. In the 1970s, painstaking research at The Australian Wine Research Institute clearly outlined the lack of pH control as a major reason for the poor quality of many Australian wines. The definition and solution of this complex problem have clearly been a major contributor to the increased quality of much Australian wine and to the much reduced use of sulphur dioxide as a preservative. The Australian industry perhaps understands the importance of this aspect of winemaking better than any other competing wine industry.

Finding: Many of the most important innovations stem from outcomes of basic research and will be adopted by strategic researchers only if the latter have achieved appropriate training in a quality research environment.

Recommendation 6: Government must continue to recognise that basic research is fundamental in a knowledge driven economy. Institutions must however demonstrate that their researchers and educators have an understanding of the path to application of research outcomes and integrate such knowledge into the training of their graduates. Specifically it is recommended that all PhD programs must include components that familiarise the students

This paper was prepared by an independent working group for PMSEIC. Its views are those of the Working Group, not necessarily those of the Commonwealth.

with the essential steps to and satisfaction to be gained from bridging the gap between the science and its application⁷.

⁷ The higher education research Green Paper notes (p 8) that “... whatever the limitations of our higher education system, there are also many vital strengths which need to be preserved and developed.”

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3.2.1.4 Gradual improvement 1: the continual decline in wine faults/the Wine Show system

During the early part of the 19th century, large amounts of Australian wine were exported to Britain. Unfortunately, significant proportions of these products were spoiled and in some cases more akin to vinegar upon arrival. The Australian Wine Show system arose out of the traditional Agricultural Show systems and was, to a large extent, introduced in order to 'improve the breed'. The Show system was instrumental in defining the extent of common faults in Australian wines and to highlight to producers whether they were supplying competitive products. The shows continually serve as a guidance and they have undoubtedly led to a better understanding of common faults and important benchmarking.

An important recent development has been the inclusion in the judging panels of influential overseas wine judges. The inclusion of such judges not only gives our industry a feel for overseas preferences but also serves as an important marketing effort, and very importantly a bench marking effort in which quality paradigms are introduced that may fall outside the scope of domestic bench marks. This understanding, combined with greater technical insights into the reasons for occurrence of faults will, in turn, facilitate implementation of corrective practices which assist our efforts to consistently produce world-class wines. Such changes operate only over the long term – but they are certainly observable and an indication of the long term effect the continued pursuit of excellence can have in the absence of quantum developments

3.2.1.5 Gradual improvement 2: the *Research to Practice*TM programs

The industry has always put a very strong emphasis on delivery of training structures and programs to assist self-supporting networks, through the initiatives of its professional bodies, with a focus on performance improvement and regional development.

The *Research to Practice*TM program is a prime example of how the industry successfully secures the application of relevant research in production through technology diffusion and training. This program has, under the primary guidance of State departments of Agriculture, operated since 1996 and a travelling road show has been established to address training needs in the areas of:

- Control of pest and disease in grapevines.
 - A workshop manual was developed and a pool of more than 40 facilitators developed across Australia. These facilitators have conducted in excess of 60 three-day workshops and more than 1000 independent growers, consultants, agrochemical company representatives and service providers have now attended these courses.
 - The workshops allow for a combination of theoretical and practical experiences in the target regions. There is very good evidence of changed practices as a result of the workshops and in some areas the frequency of spray application has dropped dramatically.
- Water management for grape production : Research to Practice.
- Grapevine nutrition : Research to Practice

The philosophy behind this approach is based on the development of more innovative approaches to extension and technology transfer. These involve alliances of interested parties, often delivering group programs, with the Grape and Wine R&D Corporation facilitating improved effectiveness and industry commitment. It does not fund delivery, but ensures that accessible, appropriate programs are in place, and supported by individuals and regional groups.

This approach is not new to the industry, but it clearly outlines that the responsibility for technology diffusion and adoption of innovation rests squarely on both research providers and industry practitioners and that the long term goal is that of sustainable national and regional industry structures with the 'eye on the ball'.

Finding: The *Research to Practice*TM programs illustrate the pivotal role RDCs can play in furthering technology adoption and 'life-long learning' where there is a market-failure to establish such initiatives.

3.2.1.6 Gradual improvement 3: the availability of sophisticated analyses through commercialisation of research outcomes

Access to the outcomes of research is not restricted to delivery through Government agencies but can take place also through commercial outlets. For example, the Analytical Service at The Australian Wine Research Institute has, over the past 14 years, offered a commercial service in which industry, on a full cost recovery basis, can access sophisticated analytical measures to better understand features and compositional aspects of their products. The lead time from research to commercial application is often very short, typically less than two years.

The areas in which analyses is offered range from flavour potential measures of grape and oak, via pesticide analyses of wine and taint analyses of corks to a unique grapevine variety assurance by forensic-like DNA typing. The latter represents a particularly interesting service, unique in the world, and designed to enhance the label integrity of Australian wine. The technology transfer is also of interest as it demonstrates highly developed inter-agency collaboration. Based on cutting edge developments in biotechnology, CSIRO developed a database and tools to distinguish 250 different cultivars of importance to the industry. The technology was then licensed to the Analytical Service of The Australian Wine Research Institute, where DNA typing has taken place for three years and still constitutes the only such viticultural service in the world. The technology further serves to enhance the label integrity program of AWBC and projects the high integrity and sophistication of the Australian products.

The Australian wine industry has been very successful at using its demonstrable commitment and involvement as a marketing tool to underpin claims that our products are clean, green and optimised in respect of flavour retention and freshness.

Finding: A concrete example of the transfer of basic research into a commercial industry service needed two institutions with complementary roles and skills. As is the case with the development of partial root zone drying above, clustering of institutions facilitates the development and application of the science.

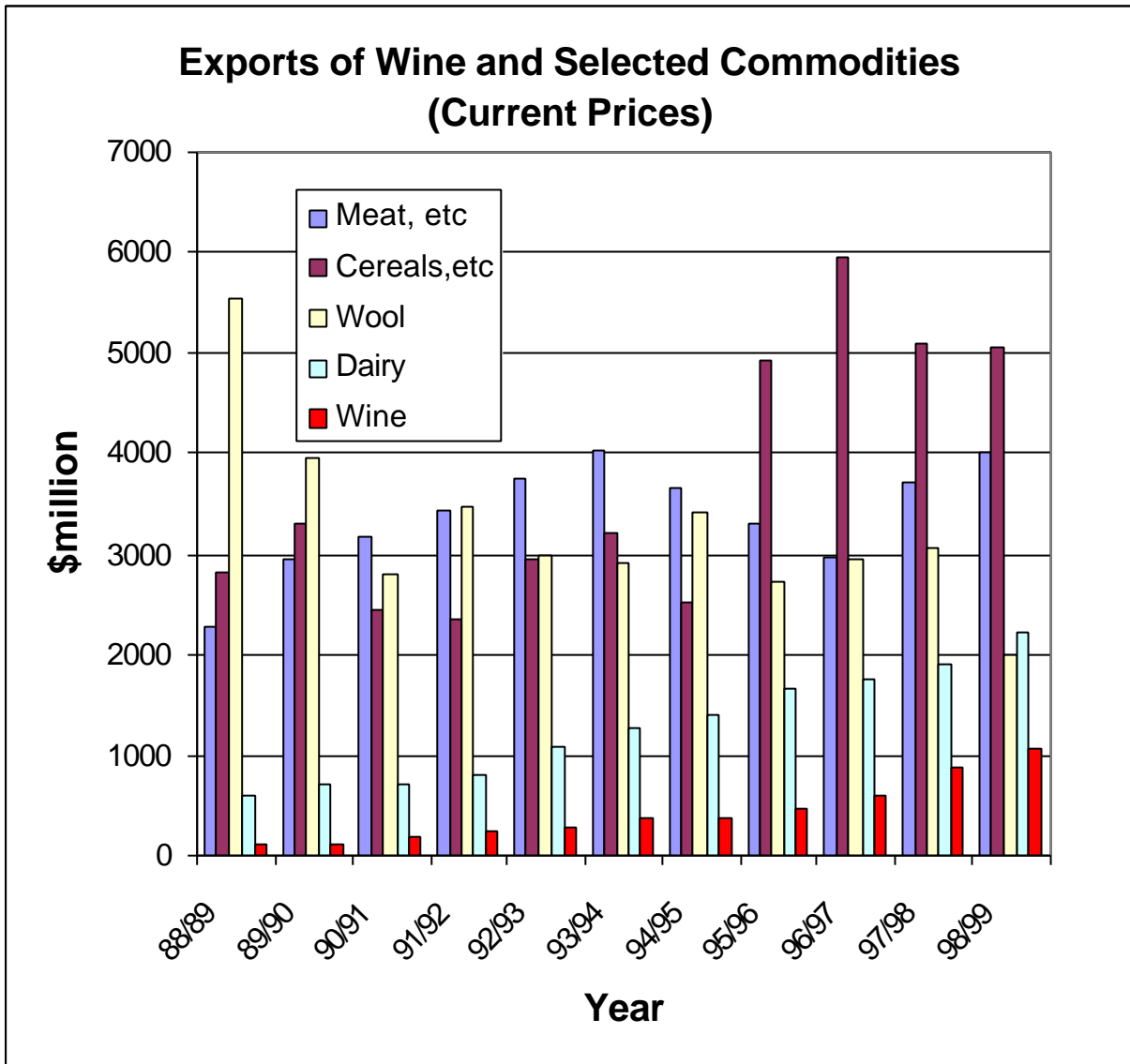
Recommendation 7: In recognition of the increasingly multidisciplinary nature of research and development as well as the cost-effectiveness of sharing resources; Governments must strongly encourage the development of research clusters and the development of shared visions and plans for such clusters. Industry specific research Institutes, should almost certainly be co-located with other research and educational providers.⁸

4. CONCLUSION

The wine industry has clearly been highly successful. A multitude of enabling factors have contributed to this success. Those under the industry's control include the people and their attitudes. These, in turn, allowed the crucial development of collective planning and pre-competitive sharing of efforts to build and protect "Brand Australia". This development has been paramount. Equally important has been the long-term commitment to engage in research and development activities through industry participation and leadership. This engagement has generated a 'can do' culture in pursuit of excellence, and a perpetual innovative streak which has transformed wine into a knowledge-based product in which 'knowledge-workers' secure small increments in production efficiency and product quality that in turn lead to large increases in image and market penetration. The development of the vertically-integrated *Strategy 2025* industry plan and the concurrent development of the complementary 5-year research plan by the Grape and Wine R&D Corporation constitutes a shining example of how an industry's collective views are transformed into a culture in pursuit of excellence through innovation.

Government cannot create such attitudes from scratch – the roles of government are to support but not drive such developments by putting in place enabling initiatives, and to ensure that national political and economic developments secure a strong base from which industries can grow their export activities. A long-term sustained and enhanced investment in industrial R&D through bodies such as the GWRDC forms an integral part of the base from which society will obtain further prosperity.

⁸ The higher education research Green Paper notes (p 22) that "Increasingly, the important and interesting scientific questions are not disciplinary ones, but problem-based ones which demand cross-disciplinary research solutions."



Source: ABS *Merchandise Exports*, DFAT STARS database

ATTACHMENT B

REGIONAL CHANGE IN VITICULTURE⁹

Region	Current Winegrape Production	Historical Growth in Winegrape Production		Potential to Grow
	1997-98	Increase production in 1997-98 over the 1988-89 level		New Planting ¹
	Tonnes	Tonnes	Per cent	Per cent
Murray valley	217,275	109,141	101	16
Riverland & lower Murray	231,870	49,441	27	21
Central SA	68,588	43,013	168	24
South East SA	68,421	25,679	60	22
Barossa	67,729	19,938	42	14
Rest of NSW	27,342	18,795	220	34
Rest of Victoria	35,251	17,585	100	27
Western Australia	21,406	13,761	180	22
Northern SA	18,923	7,034	59	30
Tasmania	3,136	2,796	822	29
Murrumbidgee	90,845	2,555	3	23
Queensland	693	378	120	26
Hunter valley	19,070	-3,003	-14	9
Australia	870,627	307,189	55	21

Source: ABS vineyard survey

- 1 Share of new planting compared to total planted area, 1997-98. Areas removed are not indicated.

⁹ Stanford, L "Australian Viticulture: Situation and Change" Australian and New Zealand Wine Industry Journal, 1999.

MAJOR AUSTRALIAN WINE INDUSTRY BODIES

Put mildly, prior to the 1990s the Australian wine industry was not operating as a unified body able to form consensus views and instigate collective actions. Through the efforts of visionary individuals this situation was rectified and our industry now displays a unity which is the envy of the collective 'wine world' and almost certainly a main driver for the current commercial success. A short outline of the peak bodies is given below.

The Winemakers' Federation of Australia

The Winemakers' Federation of Australia was established in 1990 and is financed by voluntary levies paid by its members as a function of the volume of wine produced. The Federation's mission is to develop conditions that will facilitate profitable wine industry development in a responsible fashion. WFA is the peak industry body dealing with the political and policy issues confronting the industry. In general all but a small portion of the Industry would agree that the WFA has been very effective in representing the interests of the diverse components of the industry and been able to further the collective views and professionalism of the wine Industry. The development of the Industry plan – *Strategy 2025* – is testament to this important role.

The Winegrape Growers' Council of Australia

The Winegrape Growers' Council of Australia was established in 1932, and is the peak national industry body representing the interests of approximately 6,000 independent winegrape growers who account for about 75% of Australia's winegrape production. The Council is made up of State and regional winegrape growers' organisations from NSW, Victoria and South Australia. The two broad functions of the Council are: (a) information collection, interpretation and dissemination: and (b) policy development, promotion and implementation.

A key activity which spans both of these functions is the Council's interactions with the Grape and Wine Research and Development Corporation. Through a range of Council's initiatives, grower input into R&D priorities has been considerably enhanced. Council was also responsible for establishing the unique two-tiered structure for vine health: the National Vine Health Steering Committee, whose membership is industry dominated and responsible for policy development, and the National Phylloxera Technical Reference Group, which advises and is responsible to the Steering Committee and largely comprised of technical experts. The membership and name of the Technical Reference Group changes according to the issue at hand.

The Council produces a journal, *Australian Viticulture*, which is a credible and practical source of information directly relevant to growers. National circulation is about 8,000.

The Australian Wine and Brandy Corporation (AWBC)

The AWBC is a Commonwealth statutory body constituted in 1980 and responsible for national matters such as export regulations, labelling regulations, geographical indications and, under its committee, the Australian Wine Export Council, generic promotion of Australian wine. The AWBC is governed by a board comprising a Chairman and seven members each of whom serves in a non-executive capacity.

The AWBC is funded by a compulsory levies on grapes used in the production of wine and on wine exports. Its stated mission is “To enhance the operating environment for the benefit of the Australian wine industry by creating national and international market environments in which wine producers, individually and collectively are able, through their own initiative, to achieve maximum long term demand for their products and to do so in consultation with industry and in the most cost effective way.”

The principal functions of the AWBC are to:

- operate a label integrity program to ensure wine law compliance
- issue export licenses and permits on the basis of a rigorous wine inspection program
- enhance the production and distribution of industry information
- undertake generic promotion of Australian wine including enhancement of “Brand Australia” by, for example, communicating its ‘clean and green’ status

The Grape and Wine Research and Development Corporation

This statutory body was established in 1991 and is funded by a statutory levy with matching government funds. The GWRDC is governed by an expertise-based board which consists mostly of industry practitioners and is guided in its investments by industry-based priority reference groups. The outcomes delivered through these mechanisms have been embraced by industry as evidenced by its willingness to increase levies on a regular basis. Importantly the, GWRDC 5 year plan was formulated with continuous reference to the stated objectives in the Industry’s five and thirty year plans.

What is not evident from the list above is the high degree of cooperation between the bodies listed. A tangible evidence of this is the physical aggregation of all of these organisations and their secretariats at Wine Industry House, 555 The Parade, Magill, South Australia and the high degree of cross representation on various committees.