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RESEARCH PAPER

Australia as a Triple Helix exemplar: built upon a foundation of resource and institutional coordination and strategic consensus

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Australia's phenomenal success in developing as a global wine exporter deserves more attention from the point of view of economic and competitiveness strategy. Its success embodies the expectations of the Triple Helix that there will be institutions explicitly oriented towards developing end extending industry-relevant research, and that industry targets will be coordinated with public, collective aims. Australia stretches this framework even further by showing it can work on a large scale, with multiple layers of coordination, without alienating smaller and local producers. It reinforces the findings of other successful cases in this special issue by demonstrating the importance of a common long-term strategy, the value of an industry levy that funds research, the underlying social capital that makes coordination possible, and the importance of specialisation and marketing. Nonetheless, Australia's wine industry also faces serious challenges that suggest a further evolution of its Triple Helix institutions will be required for continued success.

Introduction

If we accept the central premise of the Triple Helix (TH) that innovation comes from a synergy of interactions among the research (academic), policy (government) and industry spheres, the theory still permits a great deal of latitude in how those relationships are formed and maintained, and the nature of their interactions. The purpose of this case study is to examine how the Triple Helix works in practice. As shown in the introductory article, Australia is an excellent case study in this regard, as it is one of the most successful entrants into the global wine market in the past two decades. Australia's dramatic growth into world wine markets during the 1990s and early 2000s provides both a test case for whether the TH really works in practice and a specific example of the institutions working together.

This article is based on an analysis of secondary and statistical sources as well as a series of interviews with the key institutions in the Australian wine industry (see the Acknowledgements). The interviews were approximately one hour in length with the relevant Director(s). Interview questions were open-ended and focused on the history/mission of the organisation, approaches towards innovation, coordination efforts and issues with other institutions, and strategic approaches towards the industry, including anticipated challenges.

As we show in the article, market forces or natural competitive advantage cannot explain Australian wine success. Rather, the timing of its takeoff coincides with

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efforts to take a scientific approach to manufacturing, such as the first large-scale use of stainless steel fermentation tanks. In this article, we make the case that such technical breakthroughs can be clearly tied to the development of TH institutions. However, beyond the TH, we also find that there are additional elements worthy of note in regard to developing well-coordinated institutions and long-term strategic policies that sustain innovation in product and marketing. We also find evolutionary limits to the TH model, as the current version of the TH in Australian wine appears to require adaptation if not transition.

Australia as an historical afterthought in winemaking

Australia's recent success in global wine markets comes as a surprise given its history. While the planting of grape vines in Australia goes back to 1788, for consumption in the remote colony, for the next 120 years vineyard planting and winemaking were rather sporadic activities with little coordination and little organisation. There were several visionaries who sought to create a wine culture – men like James Busby, who was Australia's first wine pioneer, Thomas Hardy who drove development in South Australia, and Dr Alexander Kelly, who pushed so hard for higher standards. Busby had toured the Old World wine countries and collected cuttings to bring to the new nation, and actually established a substantial planting in the Hunter Valley, New South Wales – Australia's first proper vineyard. But there was also a tremendous amount of 'trial and error' taking place. The vignerons had no formal training, only a passion for what they were attempting. Many, in fact, were for the most part farmers who were experimenting with another fruit – the grape. Colonies within each of the new nation's states largely restricted themselves to growing grapes for their own communities (Beeston, 2001; Faith, 2002; Aylward, 2010).

Towards the latter half of the nineteenth century South Australia *did* begin a systematic planting regime and overtook both Victoria and New South Wales as the leading wine producing state. The establishment of multiple land acts by colonial state governments opened up large tracts of land that allowed for and encouraged these additional plantings (Anonymous correspondent, 1842; Beeston, 2001). In addition, by the 1860s a semi-structured export market for wine was also emerging and trading 145,000 litres per year, although it struggled for recognition and consistent sales (Beeston, 2001; Australian Government Portal, accessed 2011). There was much scepticism from Europe about this new Australian product and most markets shunned it with little or no consideration.

It was not until Federation in 1901 that things improved dramatically. With Federation at last came the relaxation of trading barriers between the colonial states. Wine, along with all other trading goods, was suddenly relieved from onerous taxation, and trading activity between South Australia, New South Wales and Victoria, in particular, became almost frenetic. This single act, together with a new generation of industry visionaries and leaders – men like Seppelt, Reynell and Henschke – provided the much needed impetus for industry coordination (Aylward, 2005). Now, rather than being at war with itself and fighting over internal distribution and taxes, the industry could focus its attention on developing cohesive domestic and export strategies for growth.

By the turn of the twentieth century, Australia was exporting some 4.5 million litres of mostly fortified wine to the UK. The Australian wine industry through much of the twentieth century was composed of independent wine-growing regions with the largest and most notable regions being the Hunter Valley in New South Wales, the Barossa Valley and McLaren Vale in South Australia, and the Yarra Valley and Rutherglen in Victoria. At this stage the fledgling industry largely produced bulk and fortified wine. Fortified wine lasted longer and travelled better than its table counterparts, but the style impaired the nation's reputation for making elegant wines that the tables of Europe might enjoy. According to Smith and Marsh, two major technical breakthroughs were adopted during the 1970s. The first was the introduction of new high quality grape varieties. The second was the beginning of the diffusion of major technological changes, including such improvements to viticulture as mechanical harvesting and pruning, vital given labour shortages (Smith and Marsh, 2007, pp.227 and 231). This second breakthrough came courtesy of larger corporations moving into the industry and through a number of mergers and acquisitions, transforming the landscape slowly from family-owned enterprises into larger, commercial concerns.

But there were other critical elements as well that point to the validity of the TH framework for understanding industry innovation. The industry's peak research body – the Australian Wine Research Institute – was by now well established and conducting what many considered world class viticultural and oenological research (Winebiz, 2011; Wine Innovation Cluster, n.d. [accessed 2013]). The establishment and growth of this single institution provided scientific rigour and international reputation to the industry. Like its counterpart at UC Davis in California, it was a highly respected think tank that drew expertise from around the globe. It also ensured that disease and contamination became, if not things of the past, then certainly negligible considerations.

The other substantial breakthrough was not as tangible but perhaps even more pervasive. It was cultural and it changed the thinking about wine in Australia. Soon after the Second World War Australia experienced its first wave of migration from Italy. These waves extended for the next 30 years and as the migrants settled and began securing their livelihoods, their own culture increasingly meshed with the Anglo-Saxon way of life. The 1970s particularly saw their confidence grow enough to open Italian restaurants across the cities and towns of Australia, particularly in cities such as Melbourne and Sydney, where large Italian populations had settled (Museum Victoria, n.d.; Grollo, n.d.; Korpesio, n.d.). This resulted in Australians learning that table wine, in addition to traditional beer or fortified wine, was a natural accompaniment to meals, particularly if dining out. It was not long before table wine moved from the restaurants to domestic dinner tables, even if in cask form. The important thing is that more Australians from a wider range of class structures recognised table wine as a legitimate alternative to beer. The industry's output and the quality of that output improved substantially.

By the 1980s the wine industry was beginning to show solid and sustained growth. Consolidation of research, governance and marketing were having the desired effect, and the depreciation of the Australian dollar added a further dynamic to what was by now an organised and increasingly successful export trade. More importantly, with these operational consolidations came institutional consolidation, as described below, from the previously fragmented industry, state and national associations (Smith and Marsh, 2007, pp.227–28). From this base, Australian wine exports took off during the period 1996–2007.

Export volume growth dwarfed domestic sales (see Table 1). The Australian and New Zealand Wine Industry Directory (Winetitles, 2008) shows that exports grew at an average of 26% per year between 1989 and 1998, and the number of exporters increased from 170 in 1994 to 1045 in 2006. More importantly, there was a surge in export value from 1994 ($376 m.) to 2007 ($3.003 bn). In dollar value per litre the story is the same. In 1994 it was $3.02 per litre exported and rose to a peak of $4.79 per litre in 2002. It is during this period that Australia became known as having technologically sophisticated wine producing regions (PMSEIC, 1999; Anderson, 2004).

One danger is that Australia's exports are concentrated in just several markets, as shown in Figure 1, with the US and the UK taking almost half, and then Canada and China just below 20%. It is interesting to note that New Zealand accounts for 56% of Australian wine imports and France for 31%; Italy comes next at 6.8%. The other danger, which is becoming more apparent, is that the majority of Australia's export sales in both the UK and US markets are under the $12 price-points, a category that is susceptible to price competition and discounting. This section of the market is now also being targeted by Chile, Argentina, New Zealand and South Africa, some of whose labour costs are well below Australia's. As respondents in this study

Table 1. Total wine sales and growth, domestic and exports, 1998–2011

	1998–99	2010–11	% Increase
Domestic (m. L)	348.30	463.90	33%
X (m. L)	20,088.10	74,655.50	272%
	2005–6	2010–11	
Domestic ($m)	1,899.90	2,331.00	23%
X ($m)	47,157.60	198,921.90	322%

Notes: m=millions, L=Litres, X=exports.
Source: Australian Bureau of Statistics 2010–11, Report No. 1329.0 (only available years).

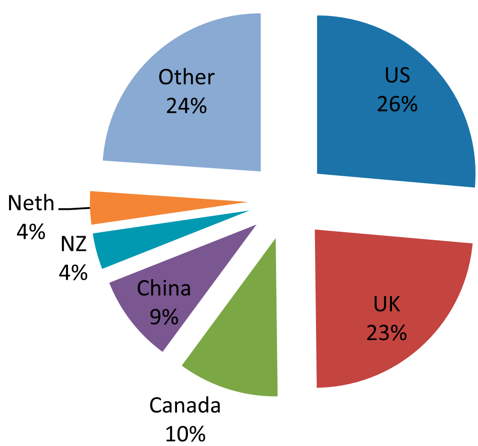

Figure 1. Australian exports, % of total sales by destination, 2010–11
Source: Australian Bureau of Statistics 2010–11, Report No. 1329.0.

verified, margins on wine in these price categories are very thin and susceptible to the smallest price fluctuation. The large retailers in these mature markets have significant influence on prices and can initiate particular discount lines to attract higher volume of sales.

As shown in Figure 2, wine production is concentrated in three Australian states, namely South Australia, New South Wales and Victoria.

Examining Australia's Triple Helix for wine

Behind Australia's success is an interesting if complex landscape of institutions that evolved to push the industry forward. That Australia's breakthrough was premised in good part on innovation is not in dispute. By most accounts, Australia leads the New World in wine research and development. One interviewee in Ontario, Canada (see accompanying article), said 'No one can touch what Australia does in terms of R&D. They are so well-resourced and organised'. Aylward and Turpin's study (2003, p.42) of winemakers in California, South Africa, Australia and New Zealand revealed that 64% ranked Australia highest, with California coming in second at 31%.

One explanation for the apparently greater success of the TH relationships in Australia than elsewhere (see accompanying articles) is that collective action is cemented through a levy system that provides consistent funding for innovation. For example, in the 1990s each single producer (of which there were approximately 2000) was charged $2 per tonne crushed as a levy for R&D. This was matched dollar-for-dollar by the federal government. In the early 2000s the levy increased to $5 per tonne crushed. These funds are directed by the peak Grape and Wine Research and Development Corporation (GWRDC), primarily through its research arm, the Australian Wine Research Institute. Projects ranging from disease control to biological agents, to pest identification and control to canopy management techniques to extension programmes are funded under the GWRDC schemes.

Research pillar

Australian institutions for wine appear to follow the formula set out in other national agricultural sectors, such as grains, where a national system for research and

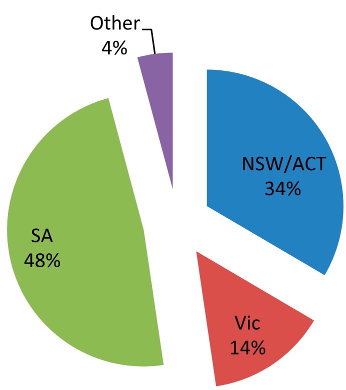

Figure 2. Wine production by state, 2010 (000s of litres)
Source: Australian Bureau of Statistics 2010–11, Report No. 1329.0.

extension was established to assist in conquering export markets. It is interesting to note that despite this, all interviewees state that there is a primary reliance on market forces as the source of decision making in the industry. Regardless of reported self-perceptions, there is no doubt that Australians have paid and continue to pay a great deal of attention to sectoral policies. A 2009 report notes that, as of 2008, the wine industry was responsible for 31,000 in direct and another 27,000 in indirect employment (Wine Sector Strategy, 2009, 3).

Besides having a central funding conduit for research, Australia has a remarkable level of coordination between industry and academic researchers, and training oriented towards industry needs that well reflects the TH framework. The Australian Wine Research Institute (AWRI) was established in 1955. The AWRI states that it combines three missions: ‘world class research and development, information and knowledge extension, and commercial services’ (AWRI). It follows the research priorities of the GWRDC, which also maintains an external review role. The AWRI’s board is composed of winemaker representatives who are elected by other winemakers. There are representatives of small, medium and large enterprises. It also includes three ‘special qualification’ directors who have expertise in R&D in this area. Among its many activities, it conducts and publishes research, teaches courses, sets up websites with accessible information, maintains a library, holds roadshows for demonstrations, and directly answers queries from winemakers about technical questions. It has over 75 employees. AWRI helps to run wineinnovationcluster.com, a joint R&D and information portal, with CSIRO (the Australian federal science agency), SARDI (South Australian Research and Development Institute) and the University of Adelaide. All institutions are based at the same location in South Australia at the University of Adelaide’s Waite campus. Personal interviews with seniors at each of these institutions about their research and coordination practices suggest the following conclusions. First, there does not seem to be a tight division of labour among the organisations; however one does not get the sense of rivalry, even though researchers are competing for funding their own projects. There are examples of collaboration across the institutions such as joint research. AWRI seems to have a more applied focus, with an emphasis on receiving input from the industry, and providing tangible outputs. Still, its researchers are expected to publish in peer-reviewed journals, which begs the question of whether academic and applied research incentives can co-exist; at AWRI, at least, lead researchers claim there is no conflict.

The Grape and Wine Research and Development Corporation (GWRDC) was established by federal law in 1991 with government statutory authority supported by a mandatory levy, partly from user payments and partly from matching funds from the government. The current levy is $2/ton of grapes and $5/bottle, again matched by the Australian government. The approximate annual budget is $20–25 million. The Board includes eight members with work experience from the various regions and an executive director with government background, as well as at least nine staff members. Board members are voted in by the membership. Aylward (2002, pp.354 and 362) notes that it works closely with R&D providers including research institutes, universities, and federal and state agencies. It also consults directly with industry service providers, such as the Australian Wine and Brandy Corporation. The GWRDC’s R&D funding works through two accounts, one for grape and another for wine. Individual companies also fund their own research, and sometimes match other government awards to researchers. Based on in-person interviews as well as a review of the research portfolio from online sources, we observe that the system appears to privilege applied over basic research, though insiders claim that industry, particularly in good times, is aware of the potential benefits of basic R&D. According to one interviewee, previously there was a sense of limited input from academic research into GWRDC prioritisation, but over the past two or three years, there has been more direct consultation. Moreover, there has been a move to provide core funding to institutions such as the AWRI to ensure long-term projects can be viable. In addition, there are individual state efforts at research and extension, as well as regional associations that get a share of levies. In fact, since 2008, following widespread criticism, there has been a concerted effort by the national wine associations to diversify their support to regional wine districts. This has come in the form of region-specific field offices and the extension of region-specific programmes that address issues unique to the particular area. There are indications that such initiatives are proving valuable and are helping to reduce the previous disconnection between policies and decisions at the centre of the industry network – Adelaide – and imperatives of winegrowers outside that centre.

Aylward (2008, p.385) points out that the Australian wine industry's move to a leadership position in the New World was based on

> a bold vision as well as a reconfiguration of infrastructure, resources, marketing and R&D … rapidly changing the sector's status from that of a domestic cottage industry to a respected participant in international markets. The organizational model behind this transition was one of centralization.

In 1991, the Grape and Wine Research and Development Corporation (GWRDC) was established with the mandate of collecting the levy from producers, setting R&D priorities and funding them from both the levy and matching government funds, in the process establishing a national Strategy around branding Australian wine as great value and consistent quality. The Strategy created a consensus around research goals, and the parallel acceptance of increased levies for research in 1998. The level and breadth of industry–university collaboration according to Aylward, is 'impressive'. The conclusion is supported by Aylward's survey of New World producers (2003, p.38), which revealed that 32% of Australian winemakers thought that R&D coordination was 'very' coordinated, as opposed to just 10% in California, 6% in South Africa and 0% in New Zealand. Indeed, researchers interviewed confirmed that they engage regularly in industry outreach, such as direct communication of results, industry conferences and seminars, and publication of articles in industry journals, at the same time that they seek to publish in peer-reviewed academic journals. Australian researchers seem unusually aware of knowledge developments across the world in the wine industry. The bottom line, according to them, is that as industry controls funding, it needs to be convinced of the value of their work.

As of 2007, there were an impressive number of students – over 700 undergraduates and 220 postgraduates – enrolled in grape and wine degrees in Australia, reflecting its strong investment in the industry (Wine Sector Strategy, 2009, p.12). The two key educational institutions are Roseworthy College at the University of Adelaide and Charles Sturt University in New South Wales (Smith and Marsh, 2007, p.234). Charles Sturt's National Wine and Grape Industry Centre was, until recently, run by its well-known director, Jim Hardie, and has over 30 staff members. It has an industry training centre, and hosts Ph.D. and post-doctoral students working on wine research. The University of Adelaide hosts the Waite Research Centre and the National Wine Centre. The former conducts research and offers diploma, BA and

MA degrees. It is hard to tell how many faculty members work on the science side, though there are at least 11 who work on wine business. The website boasts over 1500 affiliated researchers and students. The latter is a conference centre designed to increase consumer awareness of the wine industry and to host wine industry meetings. The Melbourne School of Law & Environment offers a Ph.D. in wine law and an MA in Wine Technology and Viticulture. The Australian Society for Viticulture and Oenology also carries out extension work, to spread technical knowledge in the industry. Its board members include those on the board for GWRDC and both academics and industry. A similar body, the Cooperative Research Centre for Viticulture, closed down in 2007. The Australian Vine Improvement Association is another voluntary organisation that provides high health varieties and clones and disseminates findings to improve grape growing.

Policy and industry pillars

Simply having TH institutions, even well-developed research institutions, is not enough for successful innovation, as shown in other studies in this special issue. One interesting question is why there was such a lag between the establishment of the AWRI and the quality revolution of the 1980s. A number of interviewees cited lack of access to finance as one of the key impediments. According to researchers, there was an evolutionary improvement over the decades from the 1960s which prepared the ground for the 1980s' leap forward. The Australian government invested in the wine sector in a similar fashion to its efforts in other agricultural sectors, such as grains, through regional development centres. An industry insider points to the severe recession that Australia suffered in the 1980s, forcing them to look to export markets as the 'only alternative to survival'. Perhaps a more practical answer was that the Australian wine industry was receiving historic numbers of new entrants and was subject to a dramatic escalation in vine plantings. In response to what they knew would become an unsustainable domestic market, industry associations, notably the Australian Wine and Brandy Corporation and the Australian Winemakers' Federation, pushed through the '2025' strategy to focus all their energy on internationalisation. All wineries, from boutique to large, were strongly encouraged to enter the export market and substantial incentives were provided. The move into exports in turn drove quality. Export regulations were extremely rigorous in an attempt to maintain Australia's reputation for clean, uniform wines that would not give the consumer any nasty surprises. And demands from international markets kept the rigor in place.

Another important lesson for TH efforts from Australia, then, is that industry needs to perceive a collective gain can be made by establishing a regional or national brand. This is not to say that Australia's wine industry is a homogeneous field; in fact, it is highly concentrated. Personal efforts by pioneers such as Wolf Blass led to the featuring of Australian wines as high value (affordable) and remarkably consistent in UK specialty stores. This set the standard for the breakthrough with changes in UK regulations allowing for the sales of wine in supermarkets. Supermarkets there such as Tesco allowed a handful of pioneers such as Penfolds, Jacob's Creek, Wolf Blass and Yellow Tail, now iconic, easy to recognise labels, to sell Australian wines as a cheaper alternative to Old World offerings. The ability of the Australians to produce consistent, approachable wines may have helped democratise the middle class market by broadening consumer offerings at affordable prices. The under AUS$10 wines allowed first time and occasional drinkers to participate more fully in the move to quality bottled wines, as demonstrated by the significant increase in exports to the USA and UK markets in these categories (Winetitles, 2004). What is interesting then is that, despite the domination of a few large producers, they saw the benefits of establishing a Brand Australia and supported the institutions that helped the industry as a whole move forward.

The consumer markets in the US and Canada were further developed along these lines. An industry insider points to the crucial government funding of R&D, including in mechanical harvesting and pruning, which vastly reduced costs, as well as the open-mindedness of Australian pioneers in experimenting with new techniques which broke with Old World orthodoxies, such as the now famous shift to stainless steel fermentation tanks and the use of oak wood staves instead of barrels to add flavouring. It is important also to note long-standing industry support of R&D, including the AWRI, took place long before the levy system of the 1990s began to provide a more consistent basis.

The Australian Wine and Brandy Corporation (AWBC) was established by the government in 1981 to support exports. It represented a new initiative in setting up the user-pays principle for funding through a mandatory levy which funds both research and marketing efforts. According to Smith and Marsh (2007, p.233), this development 'exposed the absences of a national body representing the interests of the small and medium producers'. Therefore, they established the Australian Winemakers' Forum in 1984. To bridge the gap between large and small producers, the government set up the Wine Industry Advisory Council at the same time.

In 1989, the Winemakers' Federation of Australia (WFA) was created on the basis of voluntary membership to pursue the interests of winemakers. It is an umbrella organisation of 10 different associated bodies representing all winemakers. The Board has 15 members, divided equally among the large, medium and small producers. It appears, however, to represent mainly large producers, as they contribute approximately 90% of production volume. The Wine Grape Growers Association and the Wine Industry Suppliers Association are also voluntary member-based organisations.

In 1990 AWBC set an export target of $200 million by 1993, matched by a major hike in funding for promotional efforts (Marsh, n.d., p.22). In 1992, a new branch of AWBC, the Australian Wine Export Council, was created to separate promotion from regulatory activities. The Australian Wine and Brandy Corporation runs the gateway website for the Australian wine industry at www.wineaustralia.com. Wine Australia is the new name for AWBC. It has statutory authority to guide the sector in all areas, particularly regulation and export strategy and promotion. Its regulatory focus is to ensure truth in advertising. Eight members of the Board are appointed by the Minister, while seven others are elected from the wine industry. It is funded by both the mandatory grape and bottle levy, an export levy, and matching revenues from the government. There are over 20 staff members in offices around the world (in key export markets). Until recently, it carried out taste tests for exported wines to ensure such wine was free from fault. However, so few wines were found to have faults that it was decided to end this activity. In recent years, it has set up a geographical indicator system as part of the new differentiation strategy for Australian wine. This is part of the regional differentiation strategy that has emerged within the industry over the past three years. The previous lack of such differentiation has been identified clearly by critics of Australian wine for a number of years, and now there are strenuous efforts to refine what has been an ambiguous and misleading set of regional indicators (Fiorina, 2009; Jameson, 2011; McInerney, 2011; Aylward, 2012). The AWBC also uses an auditing system to ensure truthful labelling; part of this includes the AWRI conducting laboratory testing.

Wine Australia plays several central roles in the current strategy, according to Anderson (2011, pp.83–84). First, it ensures quality standards for exported wine, including monitoring, labelling and geographic indications. Second, it also lobbies the Australian Department of Foreign Affairs and Trade to push for market access abroad. Third, it spearheaded the 'Brand Australia' marketing campaign that attempted to conquer new price points through developing four key segments: 'Brand champions', representing the tried and true value wines that spearheaded Australia's export miracle; 'Generation Next' appealing to young social drinkers attracted by innovative packaging and style; 'Regional Heroes', varietals linked to key locations; and 'Landmark Australia', high quality, globally recognised iconic wines. In addition it manages a large global market data gathering effort to aid exporters. Brand Australia is now being downgraded in order to emphasise regional distinctions and sense of place among Australian wines. What we have seen in the industry and policy analysis is that TH institutions alone are not enough. The Australian takeoff is based upon the development of consensually-based long-term strategies. The government can help to organise these but, in the end, industry must help to develop and fully support them.

Behind institutional success: a shared sense of fate and a common vision

We have seen thus far that centralisation of research finance using government as the authority to create a levy system and the establishment of industry collective institutions help to explain Australia's export success in proximate terms. However, behind this success is a shared consensus around a shared long-term strategy that enables Triple Helix coordination to take hold. Wine Australia produces strategy documents with long-term vision for the sector. The most famous of these was *Strategy 2025*, created in 1996. According to Marsh and Shaw (2000, p.35), the Winemakers' Federation pushed for a strategic vision around core industry values designed to increase exports and move from price-driven to premium segments. In 1999, the Australian Winemakers' Federation complemented these production advances with a large-scale marketing effort as reflected in the document *The Marketing Decade, 2000–2010* with the goal of reaching sales of $5 billion or higher by 2010 (Marsh, n.d., p.24).

A related question is why the majority of winemakers, especially small ones who live primarily from tourism, are willing to pay the levy. Here we must discern between the regional levy, collected by states, and national levies. One hundred percent of state levies come back, but national levies are allocated in an ambiguous fashion that seems to rely upon overall levels of production in each state. Support for the levy system is explained by a sense that it is working. For example, a regional manager interviewed noted that there is a local opt out for the regional levy, however, no one has ever taken it. The reason, as he states it, is 'we have three or four things that are like heroin for the winemakers. We offer them services that they really need'. So, even small winemakers see value in the services funded by the levy system. This reflects a maturity in the Australian approach that is hard to find elsewhere, except perhaps in New Zealand. Interviewees cite consistent support over time for the institutional system. Roberts and Enright (2004, pp.109–10) state that the government played a key role in the process of organising the sector, through providing direction and support to the industry. They highlight four lessons from the experience: (1) the government's ability to organise was based on using incentives, rather than regulation, to mobilise industry groups around production and marketing improvements; (2) vital to progress was the development of networks of industry interest groups, with the Winemakers' Federation of Australia providing an umbrella for a variety of initiatives; (3) restructuring led to a critical mass as well as fostering competition and innovation; and (4) collaboration was crucial to creating a national level of competitiveness. Several interviewees point to the collegial personal relationships at the national and regional levels as the source of this cooperative culture. One regional manager notes the efforts of the organisation to foster open communication between grape growers and wine producers, so that there is an understanding of expectations about price and quality. He also points to an increasingly sophisticated and varied menu of extension opportunities beyond the basic offerings, on the basis of a user-pays formula.

To wit, the sharing of the Wine Federation's office and thereby easy personal networking with the WGGA (Wine Grape Growers of Australia), GWRDC and AWBC in the impressive National Wine Centre of Australia building in Adelaide (also engaged in promotional activities) enables a coordinated effort and the forging of personal ties. The 2007 annual report by Wine Australia states that the 2025 strategy document was:

> a landmark document that created a new unity and purpose. The key target originally set was for Australian wine to achieve annual sales of $2 billion by 2010. This was achieved by 1999. Then $4.5 billion was set as the figure to achieve by the year 2025. The figure was actually passed in 2005 …. (p.2)

Marsh notes that *Strategy 2025* marked a deliberate shift to reorient producers towards export markets and the GWRDC followed suit by prioritising research funding for projects into which it fits. The result was major advances in technology used by the wine industry, such as developing cold and closed fermentation, new canopy management and drip irrigation techniques (Marsh, n.d., pp.22 and 24). Jolley (2002) puts the importance of this effort in perspective:

> The Australian wine industry has developed a set of collaborative arrangements designed to assist it in achieving ambitious goals for industry growth based on market competitiveness, quality of production, technological innovation, and the development and nurturing of an internationally recognizable 'brand Australia' as a marketing flag-bearer for Australian wines. Industry associations have provided the context within which collaboration germinated. Collaboration extended progressively from exporting to research and development, culminating in the publication in 1996 of Strategy 2025. This was the critical step, introducing a vision of the industry's potential. The Strategy provided a focus for collaborative activity in relation to domestic marketing, export development and research and development.

Discussions are underway to merge the GWRDC and Wine Australia, which would see the merging of R&D for production with research for marketing.

Challenges remain

Despite these innovations in the application of the TH (even if not conscious), Australia needs to further evolve its TH to remain successful. The TH as presented in the literature anticipates synergies, but does not consider the need for those synergistic relationships to evolve themselves, along with strategy. Australia shows that even after success is achieved, it may be fleeting unless continual evolution takes place, implying continual development and mutual adaptation of those relationships. The most immediate challenge is the emerging supply glut of wine in global markets, reflecting newer competitive entrants, such as Chile, Argentina and South Africa. Aylward (2008, pp.387 and 395) notes a number of possible strategic issues that still need to be addressed. These include the challenge of moving to higher quality, higher priced niches, a struggle as Brand Australia is known for lower price points, and consistent but generally undifferentiated quality.

A domestic glut of wine in lower price points has developed over the past decade as the boom took place. Massive plantings across the country raise concerns over the ability to move up price points. In marketing terms this is known as the most difficult strategy to achieve – the 'upward stretch' as opposed to 'trickling down'. Australian winemakers now need to convince consumers that their somewhat unexciting offering below the $12 price-points have 'big brothers' that are much more attractive and challenging, that show real character and uniqueness. It will be difficult to convince a sceptical buying public.

Interviewees concur that many grape growers, particularly at the low end of quality and price, have gone out of business. It is a trend that, unfortunately, is increasing in pace as Australia's largest two markets continue to decline. The hope in the industry is that they have passed through the nadir. However, it reflects a deeper collective action issue in regard to grape grower and winemaker relations and their long-term vision with regard to the type of industry they want. As Brian Croser continually states, the industry as a whole needs to understand that there can and should be two parallel streams of production – the commodity stream and the fine wine stream. Both are important and neither should colonise the other. The industry must represent both these streams and promote their value if it is to survive and thrive (interviews with Croser in 2010 and 2012). An Australian Bureau of Agricultural and Resource Economics report from 2009 called for a vine pull policy to reduce production, and echoes of this appeared in a joint statement by AWBC, WFA, GWRDC, and WGGA in the same year (Grant *et al.*, 2011, p.4). The default position is reliance on distorted and misread market forces to sort this out (sales rather than profit). There is an understandable wariness about the effectiveness of potential exit policies that is behind the faith in markets to sort supply out. Indeed, a forthcoming report by Fleming et al., suggests that Australian producers have thus far responded well to the entry of new competitors in the global marketplace in terms of productivity, but that creeping concerns about profitability have strong empirical grounding.

Evidently, the fallback position of relying on market forces will mean, as one interviewee put it, 'there is more pain (yet) to come'. While the need to respond to market signals is evident, it is hard to understand why more discussion around the reduction of bulk wine products and encouraging the production of more fine wine is not being adopted more rapidly. Australia's export value per litre has declined from a peak of $4.69 in 2002 to its lowest point in 20 years of $2.69 in 2011. This is a very clear indication of what the market is saying. Industry representatives still tend to think in terms of overall sales, rather than overall profit.

Improving quality requires an even deeper coordination, therefore, from grape growers to winemakers, as improving grape quality is one of, if not the, most important ways to improve quality. An idea floated by one interviewee is to meld the Wine

Grape Growers Association and the WFA into one organisation focused on the supply/value chain as a whole. New Zealand provides an interesting example of this (see accompanying case study). If there was support for this, it would create a serious challenge for ironing out suitable internal governance measures, but it would be an interesting way to move towards a more structured focus on quality grape growing.

Another challenge for improving quality is the unevenness across the regions in terms of both resource application and agenda setting. For example, the two main training and research centres, the University of Adelaide and Charles Sturt, are naturally more likely to focus on local problems. While there are regional offices set up by the national research centres, with limited numbers of personnel, these will likely be limited largely to extension work. Interviewees across the board emphasise the commonality of problems across geographies, yet one source also notes that in certain regions there is a lack of human capital. The system appears to work on the basis of log rolling by region and size as much as market and scientific potential, though this compromise may be necessary to maintain healthy system functioning.

In addition, fieldwork points out that R&D activities and extension tend to be concentrated in South Australia, home to the dominant four producers (Orlando Wyndham, Fosters, BRL Hardy and Southcorp), to the neglect of emerging wine producing regions. Thus we see a high degree of unevenness across Australian regions, and there are some signs of disquiet at the concentration of institutional resources in South Australia, to which the Australians are beginning to respond through improved spread of extension and more openness to input from other regions (Aylward, 2004). This is currently being addressed to a degree, but it requires an accompanying cultural shift by both industry associations and wineries in responding to the initiatives. Regional winemakers in particular need to embrace the strategy and become more involved in decision making, a move that will prove tentative and perhaps fraught after what many believe was a disenfranchisement of their interests. It is only with such a cultural shift, however, that progress can be made and the more these regional areas are represented, the more local differentiation will become a feature of the Australian wine landscape, both domestically and internationally.

The Australian system is responding practically to these challenges by setting up national networks for researchers involved in the industry to share knowledge through a National Wine Research Network, a National Wine Extension and Innovation Network, and a National Research Coordination Forum. The AWRI has also set up regional offices with regional priorities rather than national ones. Adjustments to the long-term relationships, including adding additional layers to the innovation system, are needed to improve regional knowledge and thereby quality and differentiation, but it is achievable. It requires a new way of thinking about objectives and strategy. While there appears to be a strong knowledge system in regard to the science of winemaking, sources cite a lack of knowledge on the viticultural (grape) side. This reflects the fragmented structure of the grape growing industry vs. concentration among winemakers. It also reflects the celebration of the winemaker in New World industries as opposed to the celebration of the soil among Old World counterparts. As every one of the 10 most iconic winemakers interviewed for an upcoming book on Australian wine commented, '90% of a great wine is made in the vineyard. The winemaker's role is rather minimal' (Aylward and Ashton, forthcoming 2014).

Yet Australia as a wine producing nation has yet to fully understand this concept. Until the concept of *terroir* is recognised as legitimate, the industry will struggle to market and sell its fine wine. In the short-run, market forces clearly favour winemakers; however in the long-run the industry's efforts to develop a serious fine wine market could be retarded by the lack of collaboration across the supply chain. Among Australia's super-premium and iconic producers (the fine wine producers) there is no glut. In fact, many of them constantly struggle to meet demand. An example is a boutique fine wine producer in the country's Hunter Valley. This producer does not supply any retailers and has never advertised in its 50-year history. Its only outlet is the cellar door and mailing lists. Yet this producer sells out of stock every single year and usually within an eight to nine month period of the vintage's release.

Nonetheless, differentiation will be quite challenging; Chardonnay, Shiraz blends and Cabernet blends currently account for more than 50% of all exports (Wine Sector Strategy, 2009, 4). There is still no formal appellation system, but informally certain regions, such as Barossa with Shiraz, Clare Valley with Riesling, Margaret River with Cabernet Sauvignon, and Tasmanian Pinot Noir, have naturally evolved towards specialisations. Industry sources suggest that this evolution results naturally from learning about *terroir* as well as more specialised local research systems developing around certain varietals. Again, there appears to be strong resistance to move to regionally-based varietals, as it would 'disrupt market forces'.

Moreover, there are longer term concerns about climate change, brought to everyone's attention through recent drought conditions in much of the country. Researchers and the industry are working on more drought-resistant rootstocks as a result. The federal government has begun to allow farmers to sell water back to the market, effectively paying them to leave the grape business. There are also hopes that Australia will be well positioned to take advantage of growth in wine consumption in Asian markets, reflecting the growth of China and India in recent years.

The 2007 Wine Australia report, titled *Directions to 2025*, reflects the ability of the TH system to respond to these challenges. It states that its purpose is providing

> a comprehensive blueprint for Australian wines to achieve a sustainable return for its 7,000-plus grape growers and 2,000-plus wine producers. It delivers a broad and sustainable strategy based on a clear understanding of such matters as market change, climate change, the environment and vine health. (p.2)

This is a response to its observation, made on p.6, that while export sales by A$ increased by 363% from 1995 to 2005, the average price per litre of export wine actually declined, from A$4.66 to $3.80 and $2.69 in 2011 (including adjustments for inflation). The report is accompanied by a series of market intelligence surveys of export markets, scouting emerging developments for the Australian wine industry. The strategy was created by a 17-member task force including grape growers, winemakers, researchers and industry organisations. It pushes for a brand segmentation strategy for Australian wine, to be adapted for different global markets (Marsh, n.d., p.25).

Therefore, one can argue that a transition plan from commodity to differentiated production could ease the pain and transaction costs. The consensual culture may mean an increase of resources for more specialised research that would lead to such outcomes. While there is a federal system that allows resources to flow down for local initiatives, such as regional specialisation, without an appellation or systematic quality control system, there may, however, be dissonance in the lack of coordination both within states and regions and across them. This coordination is critical to regionally differentiated research and branding. Again, it is an instance of market evolution requiring evolution of the TH itself, towards a system that pushes for continual quality while allowing for regions to develop expertise in specialised varieties.

It really falls upon individual companies (and to a lesser extent individual state efforts) to make the marketing distinction for higher quality and price through branding. The system could prevent breakthroughs in other regions which have lower resources at the state level and so less investment – a chicken and egg problem. This could potentially create 'free rider' problems if a smaller producer using a regional label sold subpar wine. One can ask the larger question of whether the current system can lead to either specialised research outcomes (e.g. around certain varietals attached to regions, such as Bordeaux) or basic research breakthroughs. As Australia starts to move towards a wider number of regions and varietals beyond Shiraz, the national brand strategy will become counter-productive (for those who want to distinguish themselves from 'average' Australian wine). Some industry interviewees seem to think that simply pushing the idea that Australian wine, at whatever price point, provides great value will be enough. The research system is also potentially problematic. For example, basic research breakthroughs in areas such as genomics could benefit a variety of industries, but scientists seem more hard-pressed in the Australian system to garner funds for these efforts. Moreover, the system has thrived during a period of long boom, but consensus is becoming more constrained as the market tightens. Development of the domestic market has been relatively neglected and provides another opportunity for growth; the literature on export success often cites a strong discerning domestic market as a competitive advantage. The retail system for wine, generally sold only in wine-specific stores or sections of supermarkets, may inhibit the development of a wider variety of brands as well as general accessibility and thereby demand in the domestic marketplace. However, there are reasons to be optimistic that the system will adapt, namely the growing complexity of coordination of the TH across geographical boundaries, the increasing focus on developing differentiated products and regional branding, and the consensus around the need for such a transition as reflected in strategy documents.

Conclusion

Australia has had incredible success in producing and marketing highly consistent low and mid-range price wines over the past two decades. Australia stretches the TH model by adding other elements that allow the synergy of institutions to take place, namely a cooperative culture as well as an industry-driven focus measured easily by gains in export markets. The Australian case suggests that a common levy system around a cluster coordinating body that prioritises research and extension can lead to quick improvement in both quality and volume sold in global markets. What is particularly remarkable is the ability to coordinate such a complex, multi-layered federal system around common national goals. Consistent funding provides a foundation upon which cluster improvement can take place. Improvement and levels of sophistication in knowledge, both tacit and formal, have increased over time according to long-time industry insiders.

Key institutions such AWRI emphasise the importance of doing science that is informed by industry. Scientists there are expected to have regular communication with industry, and some have understanding of business. Even more important is the fact that the significant pool of research money is guided by industry through the levy system. This creates a different incentive and culture within the research system. The Australian system is *sans pareil* in terms of creating a knowledge system oriented around the development of a particular industry. Thus, the system shows capacity to adapt and learn new technologies and to spread them in a fairly efficient manner, a rare trait. On the other hand, one could ask whether this might lead to a neglect of basic scientific breakthroughs. It is hard to judge that, but as one interviewee put it, ‘Scientists have to make the case that there is a reason for doing the basic research, and what will come of the (public) investment’. This is not an area considered directly by the TH literature, though it is a perennial question in regard to how to optimally fund innovation. One adjustment that is worthy of consideration is the fact that the levy system is oriented towards volume production. If there is an attempt to move towards lower volume and higher quality the incentive structure for long-term research can also be adjusted.

The case is particularly interesting in its long-term strategy, and the fact that a government body leads the industry. We see that the key coordinating bodies, Wine Australia and GWRDC, have mixed public, private and researcher management, however the government mandate for these bodies and the levy system is the linchpin for the TH. In addition, the research bodies place strong emphasis on moving research out to extension, including websites with easily accessible information, a Q&A query service, and a broad and deep array of training opportunities. These are backed up by an extensive export marketing effort. The efforts at extension are unparalleled in scope in our other case studies.

As with the case of New Zealand, it is hard to put a finger on the cultural sources of consensual decision-making that are the foundation of system success. Some interviewees state that a great deal of sensitivity to small producers helps the industry to reach a compromise. Others state that conflicts do exist, but are kept behind closed doors. Many point out that the recent crisis has forced producers through the supply chain to work together; however, experience and study tells us that usually the opposite reaction prevails. An industry insider notes that there is still recognition at the regional level that the large companies who move the volume have a greater say. As he put it, ‘you can’t simply run an association on the basis of a pure democracy. Considering the volumes at stake, sometimes you have to push through on the strategic long-term vision (above objections)’. Since the large producers trade mainly in bulk wine, the question becomes whether a bifurcated supply reputation can be forged. Perhaps the historical isolation of the two countries reinforces the need for cooperation. Ultimately, whatever the source, it is success that underpins the smoothly consistent development of the institutions.

The question of creating higher price points via differentiation remains an important challenge, as well as improving across regions outside of the South Australia cluster and demonstrates the need for a more evolutionary view of the TH. By absently tying varietals to specific regions, there is always the free rider problem, of a lower value wine trading on a regional reputation. The default position of relying on market forces creates flexibility, but the tradeoff may be a loss of long-term direction needed to move beyond the mid-range and the handful of iconic high priced wineries. Much depends on global and local market conditions, however, our analysis should lead to optimistic conclusions that Australian institutions can successfully adjust to meet these challenges. Australian wine from certain regions will gradually succeed in carving out a niche of distinction in world wine markets. The process would occur much more rapidly and effectively with fewer transaction costs with a more concerted strategy around support for industry transition.

We can now summarise the lessons of the Australian case study for our knowledge of how the TH works in practice. First, the TH requires a strong mandate, both to authorise the peak coordinating institutions in each of the three (research, industry, policy) spheres, and to ensure consistent funding for innovation, marketing and extension. Second, in order for these activities to have a collective benefits nature, especially given the ubiquitous unevenness of the wine industry in terms of size and market niche, both the larger and the medium-to-small producers have to buy into the system. The larger producers have to recognise that the value of regional branding improves their outcomes as well, while the smaller producers have to see concrete benefits in terms of their knowledge through extension to avoid free rider problems. Third, a TH system requires multiple layers, both in the sectorial and the geographical sense. The coordination of backwards and forwards supply chains into the TH is a challenge that Australia is still working towards. Fourth, and perhaps most importantly, behind the healthy functioning of a TH is a sense of collective fate, and a culture of cooperation and compromise. This in turn relies upon the strength of collective institutions that reflect shared personnel and outlooks able to create a long-term strategy. Finally, we have seen that even the most successful THs must evolve along with changes in market forces. Evolution, in turn, requires additional adjustment of the TH relationships themselves, in this case including deepening of the knowledge system on the regional level, and differentiation of production towards more competitive niches. While the challenge of retaining consensus while moving to a more differentiated strategy seems a high hurdle, Australia's winemakers appear to be up the task.

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Wine Grape Growers of Australia: http://www.wgga.com.au/.

Wine Industry Supplier Association: http://www.wisa.org.au/.

Winemakers' Federation of Australia: http://www.wfa.org.au/industry_organisation.aspx.