Collaborating to compete
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Abstract
Collaboration – working together, in simple terms – is of great importance in diverse, multi-player supply networks such as those operated by Australian winemaking firms. This holds whether the collaboration is between employees fulfilling similar roles within an organisation, between specialists such as viticulturists and winemakers undertaking different roles, between people from different organisations, or even at a high-level between organisations. Fundamental drivers are the common goal of maximising the value realised from assets in the supply network (in particular the grape assets), the critical need for specialised knowledge, and the geographic and organisational diversity of participants. Harvesting and grape intake proceed most effectively if the operations of grape growers, harvester operators, grape transporters and wineries are tightly coordinated, are resilient to disruptions and can adapt to unplanned events. The benefits of collaboration are clear and significant. In this paper, we look in some detail at collaborative mechanisms for intake management and computerised decision-support applications that can promote such collaboration.

Introduction
In an adaptive supply network, organisations achieve decision harmony by deploying the right assets at the right time to cover a range of foreseeable situations. In complex networks with many participants, knowledge of how local actions and variability affect network-wide performance is critical. Operations-management systems that responsively control and deploy assets at the interfaces between the participants are very useful. Collaboration is a hot topic in supply chain management and related circles, due to recognition by industry of the integral role that collaboration plays in enabling supply network adaptability and in improving performance. For example, Cousins and Spekman (2003) interviewed and surveyed purchasing and supply-chain professionals in the US and UK and concluded ‘Strategic supply implies that supply chain wide skills, expertise and capabilities are brought to bear by the full set of supply chain partners. They are united in the belief that by working collaboratively they will accomplish goals that they could not otherwise have achieved.’

The gathering of knowledge about the effect of local actions and variability on network-wide performance is fundamental to collaborative activity and to the formulation of optimised plans for constrained and changing circumstances. Because of this, it is an essential part of any adaptive supply network.

Collaboration
Brna (1998) defines collaboration as a state that has five characteristics:
• Mutual agreement to collaborate
• Maintenance of a model of other parties
• Possessing a shared goal or intent
• Holding beliefs about the shared goal
• Maintaining a shared understanding of the problem

Nezamirad et al (2004) expand on this. They propose that, although some researchers treat ‘cooperation’ and ‘collaboration’ as synonymous, collaboration should in fact be viewed as a philosophy of interaction with far wider implications. Cooperation is merely a component of a collaborative state. In order to obtain the benefits associated with collaboration, we must also acknowledge that merely cooperating with supply network partners is insufficient, and instead work to fill the conditions laid out by Brna (1998). Most importantly, organisations must share goals, share ownership of their common problems, and develop systems which seamlessly communicate information and decisions across the supply network.

The importance of collaboration in wine supply networks
Agricultural systems are inevitably subject to significant and hard-to-measure variability – climate, soil, yields, delays, quality, and so on. The variability occurs on various spatial and temporal scales, and is a major source of problems for prediction and decision-making in these systems. Viticulture represents a somewhat archetypal example, and grape-related variability propagates far downstream in the wine value chain. In addition, there are many drivers and linkages – physical, economic and social – across agricultural supply networks. Amongst the range of drivers and linkages are the different financial and social goals arising from the disparate ownerships across the network, exacerbated by the extreme differences in the sizes of enterprises (from individual growers through to multinational producers).

To consistently and cost-effectively produce a number of wines with specifically targeted attributes, a wine producer must cope with viticultural uncertainty and variability. This must be done cooperatively with its smaller partners upstream in the value chain, considering the limited decision-support resources of those partners. Our proposition is that consistency and cost-effectiveness is only achievable through a collaborative approach: starting with a continuous dialogue about the key variables which either affect or measure viticultural variability.

Good collaboration is generally evident in the wine industry; for example, in research and information relating to viticulture, oenology and the characteristics of wine. However, when it comes to managing and executing grape intake, there is much still to be done in promoting and realising collaboration within wine producing organisations, between wine producers and their suppliers, and at an industry-wide level.

Collaborating to compete
When we consider the two concepts of collaboration and competition, we might think about ‘who is collaborating’ as well as ‘what are they competing for’ or ‘what are they competing against’. For example, Australian wine producers might collaborate to compete with rival wine producers overseas and, simultaneously, a winery and its growers might collaborate to compete against
the uncertainty and variability of nature. Figure 1 illustrates some options on both sides of the collaborations-and-competitions equation for the wine industry.

Our focus in the remainder of this paper is on collaboration within a wine producing organisation and between this organisation and its suppliers, either to compete with the uncertainty and variability that characterises grape intake, or to resolve internal competition for limited-capacity resources (such as winery ferment capacity). This translates to an emphasis on the elements (boxes) that are distinguished by thicker borders in Figure 1.

Visibility and communication are important building-blocks for collaboration in supply networks. In part, this is because unhelpful and inefficient behaviour tends to occur if some parties take a restricted or localised view of the network. For example, we have seen inefficiencies caused by competition for winemaking capacity between staff in different geographic areas of a wine-producer's operations, and we have found emphasis placed on localised measures (e.g. utilisation and costs) rather than global outcomes (e.g. maximising value through wine quality). Collaboration improves the breadth and richness of the view presented to decision-makers. Computerised assistance can be an important element of this collaboration, because in complex situations humans often find it difficult to adequately digest and interpret all of the information relevant to their roles.

Collaboration and decision making in grape intake
Consider the following question: ‘How should we coordinate grape harvests, grape transport and winery operations, in a way which protects grape value and the commercial viability of supply chain participants?’ This is a question that the Orlando Wyndham Group (now Orlando Wines) and CSIRO Mathematical and Information Sciences (CMIS) have been addressing in partnership since mid-2003. It is a question that arises from strategic objectives of Orlando Wines (OW) such as:

- Maximising the value that can be realised from highly-perishable grape assets
- Retaining corporate memory, by encoding knowledge and processes
- Enabling future growth, by deploying scaleable systems that retain flexibility and efficiency

The question focuses on the grape-intake part of the OW supply network: the growers, harvesters, carriers and OW viticulture staff who collectively manage and execute the intake of grapes into wineries during vintage.

Collaboration is at the heart of the answer to this question, as well as a series of others which are relevant to OW’s strategic objectives. In a practical sense, the collaboration is oriented around communicating accurate and timely information, managing and coordinating activities in the network, and managing viticultural variability and uncertainty.

Achieving communication, coordination and collaboration in grape-intake is a tall order for OW. The supply network is large and complex. OW’s raw materials supply in 2005 included over 150,000 tonnes of grapes, 35 grape varieties, 33 distinct areas, 520 growers, 104 unique wines and in excess of 3100 harvest units (referred to as ‘blocks’, these are predetermined areas of a vineyard that are harvested as units). There were 186 harvester operators and 91 transport entities involved in grape-intake for OW’s supply network, with many of these firms also being engaged by other wine producers. The actions of the growers, harvesters and carriers resulted in a supply of grapes to six OW-managed wineries and nine contract processors.

The challenge posed by natural variability is also very significant. Grape harvest is seasonal and each vintage is different. The date of ideal maturity for a block’s grapes can differ by weeks between seasons, and these variations can give rise to large shifts in the size and the duration of peaks-of-vintage, for wineries and for classes of wines.

Even before the advent of the partnership between OW and CMIS, decision-making in the supply network was, in general, characterised by communication and a shared intent to achieve good outcomes for the participants. Nevertheless, the practice of decision-making was (and, in truth, continues to be) characterised by communications that often bordered on chaotic. Access to the data for informing decisions was “clunky” and “difficult”. Tools for helping decision-makers manage variability and produce high-quality decisions were inadequate. Overall, OW had an intake management system that affected multiple organisations but which was neither sufficiently collaborative nor suitable for the complex and competitive industry of the future.

Enabling collaboration with technology
Harvests are driven by vineyard maturity and wine attribute targets. This means that accurately predicting when the grapes in a block will reach maturity is vital. Without accurate maturity predictions, good forward-planning of grape intake a week or more ahead is effectively impossible. Such forward-planning is essential for a large wine producer. Accurate maturity predictions rely on growers and wine producers working together to gather the necessary information. In OW’s supply network, this means growers need to sample vineyards regularly and pass the samples to OW for laboratory analysis. The resulting data is fed into a statistical model which predicts the date of ideal maturity for a specified Baumé target.

Interestingly, an upgrade by CMIS of OW’s statistical model led not only to better maturity predictions but facilitated collaboration between OW’s viticulture and operations staff, in a way that was initially unexpected. Senior viticulturists in OW regularly produce, during vintage, what is referred to as the vintage plan. The vintage plan assigns a harvest-week to every block in the supply network that is overseen by a viticulturist. When this information is suitably aggregated and displayed, it gives a very insightful picture of what can be expected in the supply network during the remainder of vintage. From this, a host of important operational decisions can be arrived at in an informed and ‘network aware’ way.

![Collaborations and competitions](image)
Ideally, a vintage plan is created using both high-level information and detailed local numerical data that the viticulturist gathers via continuous collaborative dialogues with winemakers, with grower liaison officers and with other key stakeholders in the intake management process. A good vintage plan is vital for good intake-management performance. However, without accurate local numerical data, the perceived value of the vintage plan to its audience quickly diminishes, and the collaborative process stalls. This leaves the key stakeholders in the intake management process without an overarching view of vintage. The result can be chaotic and inefficient competition for shared resources, an outcome that could have been avoided.

In the 2006 vintage, a step-increase in prediction accuracy and the provision of new tools for vintage-plan creation gave much-needed momentum to the collaborative vintage planning process. The tool, known as the Vintage Planning Workbook (VPW), is an Excel-based software application. A screen-shot is provided here as Figure 2.

The VPW gives the senior viticulturist the ability to move blocks between weeks and between wineries, correct data errors, automatically update the vintage plan using new information, plot maturation curves for selected blocks, and view the aggregated information in a wide variety of ways. After deployment of the VPW, senior viticulturists in the OW supply network achieved a much greater high-level influence on the flow of vintage activities in the network. Communicating a higher-quality vintage plan led to better decisions in the field, and better grape intake performance overall. Furthermore, from an IT perspective, the VPW is now able to be used to gather high-level planning data for automated intake-scheduling software applications.

An example of automated intake-scheduling software is the parcel planner developed by CMIS prior to the 2006 vintage, and described in some detail by Dunstall and Johnstone (2005). Some of the mathematical considerations behind software of this kind are explored in Singh et al (2005). The parcel planner forms parcels (groups) of similar fruit to be fermented together. Through this, it develops a rough-cut decision as to when blocks should be harvested and which fermentation tanks should receive the grapes from these blocks.

From a collaboration perspective, the parcel planner is interesting because it enables a ‘virtual’ collaboration between winemakers and a range of people who are in the intake management process, both inside and outside OW. It does this by using electronic encodings of winemakers’ grape-batching policies and preferences. These are used to inform the like-with-like grape batching decisions and fermentation-tank assignments that are made automatically by the parcel planner. This can be done on a nearly continuous update cycle. Feedback, in the form of the harvest-and-crush timetabling decisions made by people in intake-management roles (e.g. harvest booking assistants), can regularly initiate the formation of responsively-revised parcelling plans. It is not practical for a winemaker to maintain this level of collaborative interaction with the rest of the supply network in a personal way, but the automated approach enables it to be done in a ‘virtual’ way.

The VPW and parcel-planner are examples of the tools developed by CMIS for intake management in OW. The tools deliver high-quality information and decision-assistance to many supply network participants internal to OW, who in turn collaborate with participants outside OW. The tools promote collaboration but, of course, cannot ensure it. Good business processes, a suitable intake management structure, and shared goals and understandings of the problem are of comparable importance for fostering collaboration.

There remains a significant amount of work for CMIS and OW to do in order to improve the collaborative intake management system. Yet, as described in Dunstall and Johnstone (2005), there has already been considerable positive impact on intake management collaboration and performance. One of the highest priority activities for the 2007 vintage is bolstering information exchange and collaborative dialogue between OW and its suppliers of grapes and services (i.e. the growers, harvesters and carriers).

**Concluding remarks**

We suggest that there are four key elements in high-performance collaborative intake management systems. First, because of the distributed and multi-participant nature of wine production, the overarching aim must be to bring a network view to local decision-making. This requires that intake management occurs in a collaborative environment that broadly conforms to the conditions proposed by Brna (1998). Secondly, there must be an up-to-date and reliable rough-cut plan for whole-of-vintage (i.e. a vintage plan). A good vintage plan guides a range of detailed intake management decisions and brings stability to the system. Thirdly, there must be efficient and “network aware” resolution of competition for constrained resources. This is achieved by communication and collaboration, and can be greatly aided by decision tools. Finally, it must be recognised that much planning activity is associated with the progressive reduction of uncertainty surrounding both the ideal and best-compromise time at which harvests should occur.

Consideration of this final element brings us squarely back to the issue of managing viticultural variability. This can be regarded as collaborating in order to compete with nature. By progressively reducing the uncertainty due to this variability we can more confidently assign resources and coordinate the complex multi-player activities in the supply network. Managing the viticultural variability in a wine supply network relies heavily on collaborative dialogue to bring critical information through disparate and distributed channels to the decision makers who need it.
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References