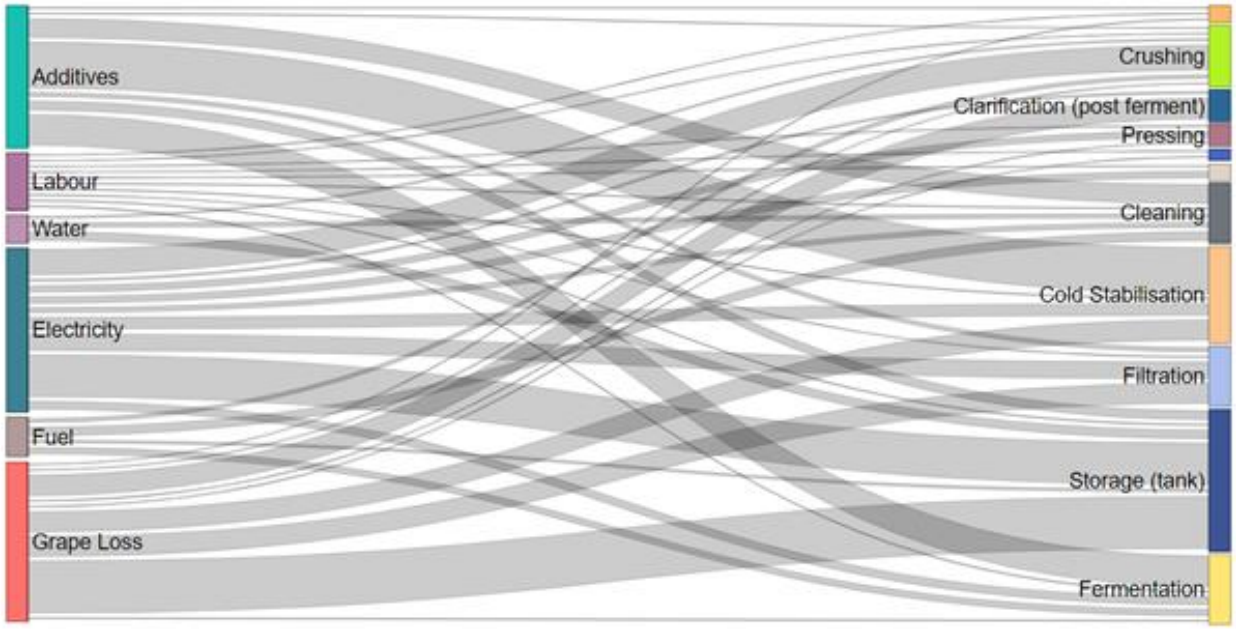
Australian Government
Wine Australia

2XE

ABC Tool & Benchmarking Database



FINAL REPORT TO WINE AUSTRALIA

Project Number: **2XE 1501**

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Research Organisation: **2XE Pty Ltd**

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Abstract

Winery production costs and performance metrics via Activity Based Costing (ABC) techniques can provide valuable information that wineries can use to assess their production costs, and benchmark their performance. This project involved developing a user-friendly, winery specific ABC tool to encourage wineries to make data-driven, evidence-based decisions to improve operations.

The project used a variety of data allocation methods and iterations of industry consultation to develop and refine a web-based ABC tool. This tool is now available for the Australian Wine Industry.

Executive Summary

A fundamental knowledge gap exists in the wine industry in the form of publicly accessible wine processing and production cost information. This information is critical for driving operational improvements and improving decision-making.

This data can allow wineries to assess their production performance, compare their performance internally, and compare performance with peer wineries. This data can be used to both encourage and empower wineries to make data-driven, evidence-based decisions on process improvement projects, improve operations and maximise profitability, sustainability and efficiency.

Activity Based Costing (ABC) is a costing method that identifies activities and assigns operational costs to these activities. In the case of the wine industry, these activities comprise the various steps and different methods used in the wine production process.

The principle behind Activity Based Costing (ABC) is that activities are the primary drivers of operating costs. In order to better manage costs, it is critical for wineries to understand how operational process steps or activities consume costs and resources.

The result of ABC is the provision of information that can help inform wineries and provide a strategic direction to modify or change processes to improve efficiency and performance.

Traditional ABC can be time intensive and requires basic levels of operational information. The ABC Tool was developed in consultation with the wine industry to identify readily accessible sources of information, without being burdensome on time and effort. The overall objective was to create a simplified, winery specific ABC Tool that provides critical production information while minimising user effort.

Based on industry feedback, two critical requirements for the tool was to minimize the time and effort required for data collection and input, while providing visual information to enable users to understand performance at a glance.

The benchmarking portion of the ABC Tool collects anonymous aggregated data to develop an overall industry benchmark in relation to the size of the winery. As more wineries use the tool, the industry benchmarking information will continue to improve in accuracy providing effective benchmarking for year-on-year performance.

Multiple iterations of the ABC tool were developed in response to industry consultation, user experiences and the development of pertinent data. The ABC Tool is now a publicly accessible online tool that wineries can use to create their own ABC model while identifying and comparing industry performance benchmarks.

Resources were invested in simplifying the tool, increasing the user experience and providing real time feedback to wineries as users entered data into the system (e.g. providing performance metrics as resource quantities were entered into the system). This was done to encourage wineries to continue to use and complete the tool based on the information available. Wineries with the data readily available (through internal resource tracking systems), will be able to rapidly generate their own model. Wineries without this critical internal performance data will be encouraged to implement systems to collect this data both for the ABC tool and for basic operating performance.

The tool is publicly accessible but has not been widely publicised. Despite this, wineries have used and accessed the tool based on word of mouth. Ongoing effort will be required to promote and encourage the use of this tool so wineries can drive and create their performance models and improve winery efficiency.

2XE would like to thank Wine Australia for their support and financial contributions to this project. 2XE would also like to thank the ABC steering committee and preliminary users of the ABC tool for their valuable input and patience. 2XE would also like to thank JP Media for assistance in converting the ABC Tool into an online platform for the wine industry.

Background

Addressing a critical knowledge gap in the industry

Understanding and managing costs is a critical step for wineries to remain profitable and prosperous in a changing global and economic climate. Information about production costs is therefore a critical enabler for the economic sustainability of wineries. Calculating production cost information can assist wineries to identify how to make the most cost-effective improvements to their operations, thereby increasing winery profitability and efficiency.

A fundamental knowledge gap exists in the Australian Winery sector with respect to the availability and use of wine production cost information. This information can be used to drive operational improvements and improve decision-making. A recent 18-month study (led by 2XE) into life cycle cost analysis (LCCA) of wineries[1] revealed that:

- Process improvement decisions were based on minimal information with respect to their existing cost of production (i.e. decisions were made by 'guesswork' rather than data-driven, evidence-based foundations).
- Decision making information was derived from traditional cost accounting methods and data sources, which were considered difficult to use to determine future operating costs.
- The wine industry does not currently have access to meaningful production-cost benchmarks[2] to compare their performance, either against domestic or international competitors.

A previous LCCA study, (that involved a trial of production-cost modelling in wineries), found the use of Activity Based Costing (ABC) an appropriate method for translating traditional cost accounting data into production-cost models. The use of these models can be used to estimate which processes and activities are consuming the most costs in a winery, and hence enhance decision-making capability with respect to process efficiency improvements.

The results and recommendations arising from this previous LCCA study have suggested addressing this critical knowledge gap in the market by:

- Developing a user-friendly ABC Tool for wineries to assess their production costs, model the impact of efficiency improvements and encourage evidence-based decision making to manage costs.

[1] Life cycle cost analysis of wine processing (2XE 1301).
[2] While benchmark data sources such as IBISWorld can be used by the industry, the wineries interviewed found this type of information too high-level (and therefore not useful) to begin to draw meaningful comparisons or insights into production-cost performance.

- Developing performance benchmark data to assist wineries compare their costs of production with industry averages and strive for performance improvement
- Delivering an extension program to the industry to encourage the uptake of tools such as Activity Based Costing and performance benchmarks to enhance the knowledge and the capacity of the industry

The literature review and market research undertaken in the previous LCCA study indicates that no such activity performance tool or performance benchmarking database currently exists (or is readily available) for the wine industry, indicating that the introduction of such a tool would be novel to the Australian wine industry.

ABC Principles

The principle behind Activity Based Costing (ABC) is that **activities** are the primary drivers of operating costs. In order to better manage costs, it is critical for wineries to understand how operational process steps or **activities** consume **costs** and **resources.** In this case, resources refer to grapes, water, materials, energy, labour and other cost items in a winery.

Traditional accounting relates resource costs to an existing line item that has been incurred or will be incurred in the future (Figure 1). These costs have already been accounted for and this reduces the incentive for change. For example, reducing electricity costs through traditional accounting involves decreasing the funds allocated to a line item. This reduction does not create a strategy or action to enable this reduction; rather it is the desired outcome.

ABC traces cause-and-effect costs and assigns all costs to various activities throughout a process (Figure 1). **Changing or modifying** a winery activity (e.g. modifying wine storage temperatures, improving refrigeration systems, changing pressing techniques, etc.) will modify the costs associated with this activity.

ABC creates a structure to gain information and provide an understanding of activities that drive operating costs. Developing a comprehensive winery activity cost model can allow a winery to identify which activities contribute the most to operating costs, and therefore, which activities should be modified to manage operating costs.

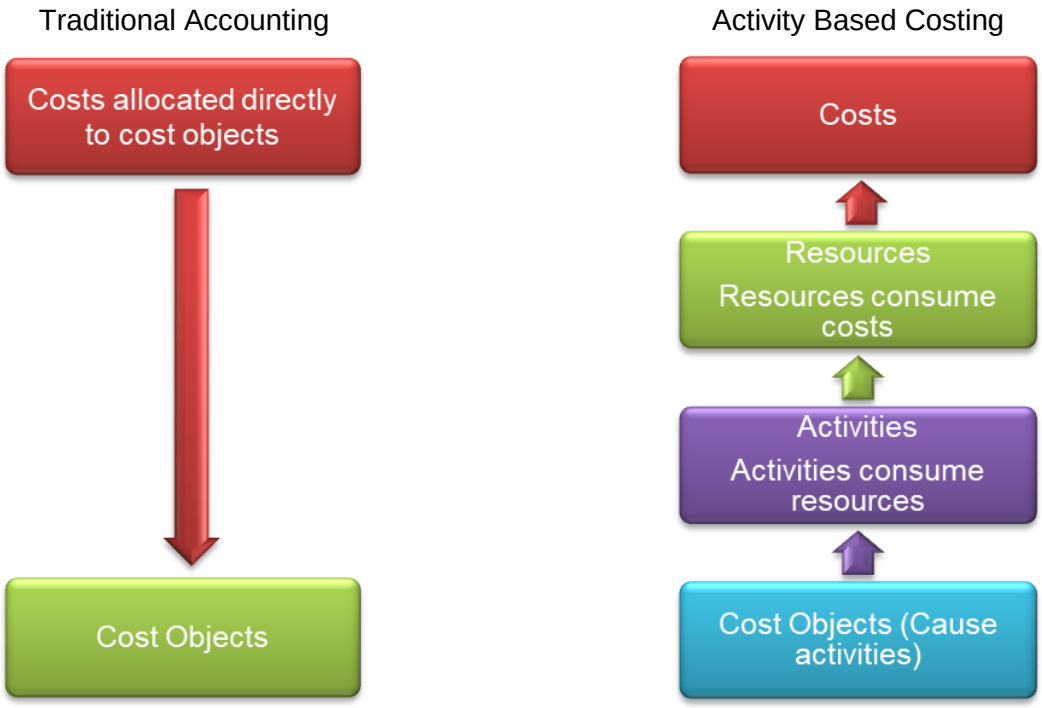


Figure 1: Comparison of traditional and activity-based costing

Project Objectives and Key Outcomes

The objective of this project is to develop a user-friendly ABC tool that wineries can use to assess their production costs, model the impact of process efficiency improvements, and use the tool's data outputs to inform decision-making with respect to process improvements and innovations. The ABC Tool will be supported by a benchmarking database, which will enable wineries to compare their production costs with their competitors and domestic industry averages.

The key outcomes of this project include:

- The delivery of a user-friendly, do-it-yourself ABC tool that wineries can use to inform decision-making and benchmarking
- The delivery of a benchmarking database, consisting of resource consumption and production cost data from a representative portion of the wine industry. This will enable Australian wineries to benchmark their production cost performance against their peers and competitors, both domestically and internationally, now and over several years of change.
- The delivery of an extension program to the industry, encouraging the uptake of Activity Based Costing and performance benchmarking via the ABC Tool and Benchmarking Database (hereby referred to as the **ABC Tool**)

Method

Overview

The project involved three main phases for the generation of an ABC model (summarised in Figure 2.)

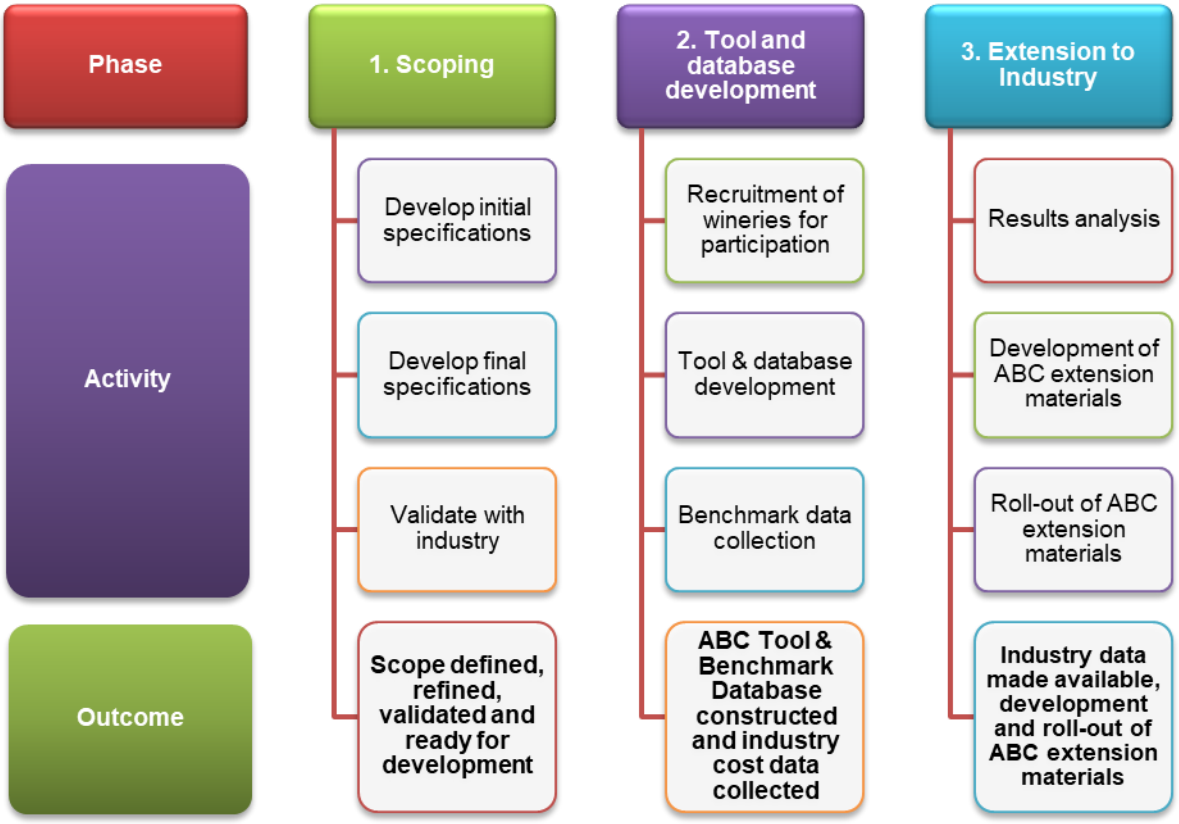


Figure 2: Method overview

Planned approach

Details of the phases and expected outcomes are detailed in Table 1.

Table 1: Planned approach and expected outcomes

PHASE 1: SCOPING
1.1: Develop initial specifications for the ABC Tool and Benchmark Database • Review feedback and encompass this into the new ABC tool • Define specifications for the ABC Tool and Benchmark database
1.2: Develop final specifications for the ABC Tool and Benchmark Database • Validate specifications of the ABC tool and benchmarking database
PHASE 2: TOOL & DATABASE DEVELOPMENT
2.1: Recruitment (wineries) • Define and implement recruitment strategies • Develop and distribute a preparation guide to participants • Confirm participating wineries
2.2: Tool development – core mechanics, shell, user interface and database • Develop the ABC Tool's core mechanics, shell, and user interface • Develop the shell for the Benchmark Database
2.3: Tool development – populate benchmark database and tool refinements • Populated benchmark database with winery production costs for ~30-60 wineries • Test and refine the core mechanics and user interface of the tool • Delivery of completed and refined tool.
PHASE 3: ROLL-OUT AND EXTENSION
3.1 Results analysis and reporting • Provision of wineries with their performance reports • Provision of completed ABC Tool & Benchmark Database to Wine Australia • Provision of analysis report summarising results from benchmarking dataset
3.2 Development of ABC extension materials • Provision of a publicly available Guide for undertaking ABC in wineries • Provision of short instructional videos/animations on ABC and how to use the ABC Tool & Benchmark Database • Preparation of case studies demonstrating how wineries have used ABC to benchmark and improve production cost performance and decision-making. • Preparation of a Journal Paper on the ABC Tool/Database & project.
3.3 Delivery of ABC extension materials to industry • ABC Tool and Benchmark Database publicly launched and accessible to the Australian wine industry • ABC Tool and all extension materials publicly accessible via Wine Australia • Delivery of presentations on the ABC Tool, Benchmark Database and broader ABC project at key industry conferences and events.

Deviations from original method

Phase 1 - Phase 1 was undertaken as per the original planned project methodology

Phase 2 - During the development of the ABC Tool, some modification was required. In particular, the diversity of winery operations, business structures and available data required multiple iterations of the tool both at the development and testing stages. These deviations are described in greater detail in Phase 2 of this report.

Initially, the ABC Tool was developed using a modified Microsoft Excel and Microsoft Power Bi platform. During the testing phase of the project, it was found that many wineries had older and incompatible versions of excel, reducing the accessibility for many wineries. For this reason, the platform was changed to use a web-based version of the Tool using Amazon Web Services (AWS) cloud computing database. This system maximises accessibility of the ABC Tool, but, incurs a monthly fee for both the storage and computation of data. The initial ABC tool was intended to be freely available to the Australian wine industry, however, the tool may require a minor subscription in the future to maintain running costs.

Phase 3 - Phase 3 initially had provision for guides or instructional videos about how to use the ABC Tool. Since the investment into a web-based system, resources were diverted into increasing the user friendliness and create an intuitive tool rather than developing additional guides.

Phase 1 – Scoping

Review knowledge and data driven tools

This section of the project involved collecting and reviewing existing information from various sources. The purpose of this was to scope an initial set of specifications for the ABC Tool.

The sources of information included:

- Outcomes and recommendations from the previous LCCA research project
- Feedback from wineries since the release of the public report
- Recommendations from the ABC Tool steering committee (appendix 5.1)
- Review and assessment of winery data-driven tools, (e.g. The Australian Wine Research Institute (AWRI) - Entwine program (appendix 5.2)

This review revealed an array of findings and considerations for this project. Most of these findings are summarised in the method section of this report, however, a summary of key considerations is included below.

User perspective

What users have liked

- The ability to understand operational costs in a different manner (compared with traditional accounting)
- The ability to benchmark performance compared with industry average results.
- The format of charts and the ability to understand winery performance
- Performance metrics (some users reported that performance metrics were being used as site wide KPI's for performance improvements.

Opportunities for improvement

- The interface must be easy to use and intuitive
- The input of data must require little effort
- Users do not want to collect additional process information to create an ABC model

Entwine perspective

Overview

Entwine is a sustainability program setup to support growers and winemakers achieve high standards of environmental care, social and economic impacts, and their commitment to sustainability. The Entwine system focuses on areas where growers and winemakers want to see improved efficiency and cost savings in their operations – predominantly water and energy use. The findings from interviews with Entwine Coordinators is included in appendix 5.2.

What has worked well

- Entwine has provided the AWRI with intelligence about the problems in vineyards across Australia. This has allowed the AWRI to provide targeted support during their roadshows.
- Entwine participants liked the 'easy to read' results
- Vineyards are now using the reports from Entwine as a system for measuring KPI's.

Challenges

- It is extremely challenging to get data (or correct data) from participants
- The reports generated from Entwine need to be shared internally within an organisation. Many times, the people entering data or receiving the reports are not distributing the information to the right people (e.g. reports are not received by winery or vineyard managers who can make changes to processes).

Other key considerations

- It is challenging to make a model that is easy to use (and doesn't require high time inputs) yet still has enough data to produce meaningful results.
- Less is more. The more effort, the less likely people will be to use it
- People won't invest time if it takes too long to complete

These considerations were included in the development of the ABC Tool and database.

ABC Metrics

Users of the LCCA trial and Entwine systems have communicated that LCCA and Entwine results have been used as an **internal benchmark** for Key Performance Indicators (KPI's). This is an excellent outcome and can be used to drive sustainability within wineries

The following list of metrics or KPI's is included in the ABC model.

- Electricity – $ / MWh
- Electricity – $ / kL
- Electricity – kWh / kL
- Labour hours / kL
- Labour $ / kL
- Water kL / kL
- Water $ / kL
- Fuel $ / kL
- Fuel GJ / kL
- Additives $ / kL
- Depreciation $ / kL
- Wastewater / kL

These are high level KPI's and can be used to benchmark performance between wineries (or provide information such as average **$/MWh of electricity** for wineries when negotiating new prices with retailers.

The ABC tool allows wineries to drill down further and create additional KPI's both for a resource, or, the ultimate target, the cost of an activity. For example, the metric **refrigeration electricity kWh / kL of wine**. This can be drilled down further to the activity **must chilling $ / kL of wine processed**.

Drilling down to these levels provides information needed by wineries to change a process. For example, the business case for changing the activity **must chilling** (and the reduction in the cost of refrigeration electricity compared with the increased labour costs associated with night harvesting of grapes).

Results from Scoping

Based on the results from Phase 1, the specifications for the ABC Tool were developed. These are summarised in Phase 2 of this report.

Phase 2 of the project (Test and validate ABC Tool), involved working with more wineries to collect and input data into the draft ABC Tool. Based on the data available from these wineries, the initial specifications identified in Phase 1 required further refinement and alteration to accommodate available winery data. This became an iterative process to ensure the ABC Tool could accept a wide variety of data regardless of size or complexity of the winery. Details of these changes are included in Phase 2 of the report.

Phase 2 – Tool and Database Development

This Phase was used to recruit wineries into the program, complete the development of specifications for the ABC tool and test / validate the tool using winery data.

Recruitment

Identification of Key users

For every winery, there are many potential users – each with a specific focus on how to use the tool. A list of the key users and their considerations are included below.

CFO's / Accountants

CFO's / Accountants play a critical role as they possess much of the accounting information needed for the tool. They also play a role in identifying expensive activities and providing the business case for changing processes or equipment.

Continuous Improvement Managers

This tool can form the backbone of CI Managers roles to identify high-cost activities and identify areas for targeted improvement.

Winemakers

This tool provides information for winemakers so they can understand the true costs of processes within the winery and factor in costs to winemaking decisions.

CEO's / General managers / supervisors

Like CI managers, this tool can be used to illustrate to managers and supervisors cost comparisons within their area including opportunities for improvement.

Steering committee

2XE engaged the support of a steering committee from a variety of wineries across Australia. Originally, the Steering Committee comprised of members from the previous LCCA project. However, due to various staffing changes at the wineries, several new committee members were chosen for the project.

Details of the steering committee members and meeting outcomes is included in appendix 5.1.

The steering committee provided valuable feedback and were used to test many aspects of the model.

Engagement mechanisms

Throughout the project, many different engagement mechanisms were developed to reach the key users in wineries.

Existing clients

2XE used our existing client base of over 50 wineries for part of this initial engagement. As the trial progressed, 2XE identified that small wineries often did not have the time, resources or information necessary to use the tool. Where possible, medium sized wineries (>500T) were actively recruited.

Database searches

2XE used WineTitle Media's Online directory to select wineries that were deemed to be an appropriate size and scope. This included wineries with a processing volume over 500 Tonnes or with a storage capacity over 200,000 litres.

Marketing material

As part of the recruitment steps, 2XE developed a range of flyers and presentations for distribution to key decision makers in wineries. These were distributed either directly or in conjunction with industry associations (E.g. SAWIA, Mildura Development Corp, etc). These have been included in:

- Appendix 1.1 – ABC Explained Flyer
- Appendix 1.2 – ABC Tool presentation

Non-disclosure agreements were also developed and provided to participating wineries if required (Appendix 1.3 – Non-disclosure agreement)

Data templates

As the model was undergoing an iterative process, a series of collection templates were produced to allow wineries to begin data collection (without the use of a fully functional tool)

The data collection forms were developed and trialled with participating wineries. Some wineries reported that the information requested was too arduous, and various versions of data collection templates were developed to simplify and improve the process. Details of the data collection forms are included in:

- Appendix 1.4 – Initial data collection form
- Appendix 1.5 – Revised data collection form (Part 1)
- Appendix 1.6 – Revised data collection form (Part 2)

Outcomes from recruitment

116 wineries across Australia were contacted for participation in the ABC program. From this recruitment strategy,

- 20% did not wish to participate in the program.
- 9% did not have basic data and were unsuitable for participation
- 38% wanted to participate but did not provide data
- 13% provided incomplete data, but enough to construct a basic ABC Model
- 21% provided comprehensive data for a robust ABC model

A summary of the stages and data available from each winery (anonymously) is contained in Appendix 1.7 – Classification of winery participants. This provides an overview as to what data was simple to collect, and what data was challenging to collect.

Based on the data provided by these participants, the inputs, outputs, core architecture and functionality options of the tool have been modified. The model continued to evolve as additional information and feedback was provided by these participants, and the model further refined to accommodate these needs.

Tool Development - Specifications, testing and validation

This section of the report summarises scoping and testing parameters needed for the ABC Tool.

The process of scoping, testing and validating the ABC Tool has been an iterative process. The development of the ABC Tool has been based on the feedback and data available from the 30+ wineries that participated in the program. The final ABC Tool is significantly different compared with the initial internal parameters. There are several reasons for this including:

- The availability of process and resource data
- The variation in production and winery business operations
- The diversity of processes within a given winery activity
- The ability to measure boundaries within a winery operation.

Based on the initial and iterative specifications, the features outlined in the remainder of the report are included in the ABC Tool.

High-level Architecture

Figure 3 illustrates the high-level architecture of the ABC Tool. There are 5 main components of this architecture.

1. The winery input cost data structure. This is the interface that will be used by wineries to input resource data, cost and the allocation quantities or resources
2. ABC Tool. This is used to calculate cost, use and the allocation of resources against activities
3. Benchmark database. This is used to store winery performance and activity cost information for use in subsequent reporting systems
4. Winery Production cost data. This is used to provide a winery with their resource performance and activity performance data.
5. Consolidated Industry Benchmark Data. This is used to provide wineries with a comparison of their resource and activity performance compared with wineries of a similar size.

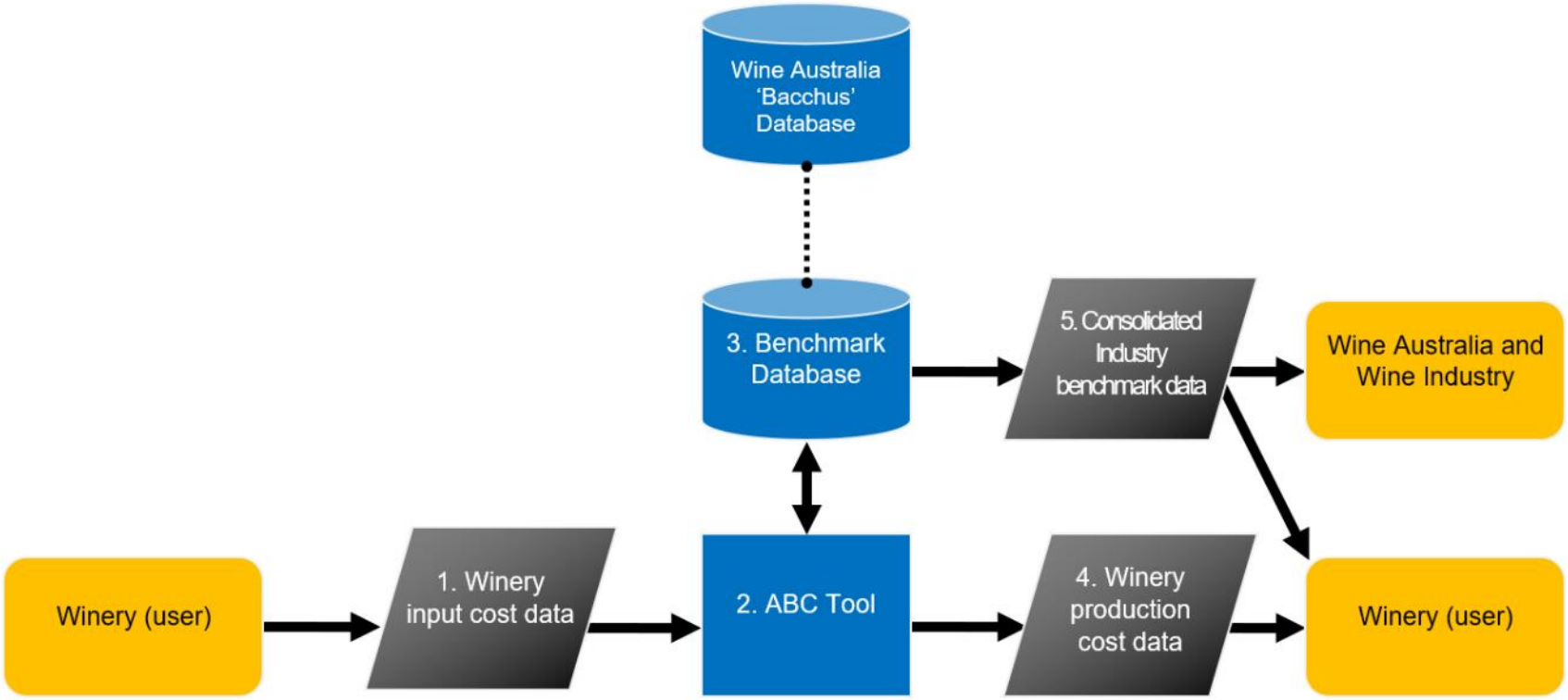


Figure 3: ABC Tool and Database Architecture

Core mechanics and allocation

The following section outlines the core mechanics of the ABC Tool and the allocation method used. The flow chart in Figure 4 provides an example of electricity data flow within the ABC Tool.

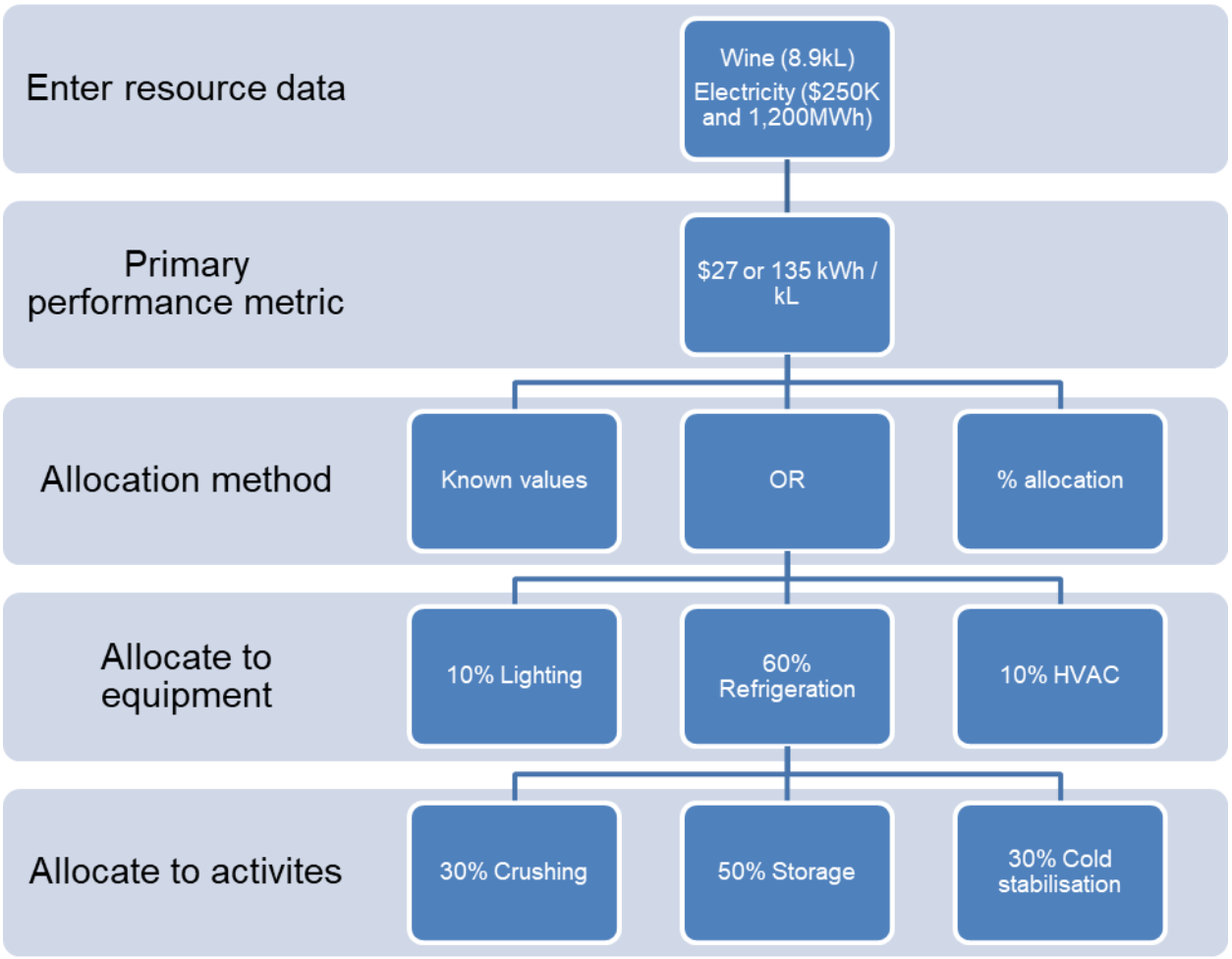


Figure 4: Electricity allocation flowchart

One of the core considerations when developing the ABC Tool was to determine how participants could allocate resources such as electricity, labour, energy, etc. to an activity. For example, many wineries could easily allocate electricity if they had completed an energy audit. Cellar labour in some instances could be allocated against activities based on 'job sheets' that provided a clear record as to which activities had been undertaken. For many wineries, the accurate allocation of resources against an activity is not always possible due to a lack of meaningful production data. For this reason, the ABC Tool can accept either specific values for allocation (E.g. Refrigeration uses $150,000 or 720 MWh of electricity per annum), or a percentage allocation of overall electricity consumption for the winery (E.g. 60% of total site electricity is used by the refrigeration system).

Tool reiterations

During the development and trial of the model, numerous challenges were encountered. This section summarises several of the key challenges that drove the need for reiterations of the ABC Tool.

Information availability

The largest challenge was the scarcity of process data available at each winery. Many wineries did not have critical information or the time to collect/compile the data required. Wineries lacked the necessary information needed to break down core resources against activities.

- **Example 1**. The winery had a total labour cost for the winery but did not have knowledge of where this labour was used.
- **Example 2**. The winery had electricity costs but could not separate electricity used for the winery from the electricity used for cellar doors or restaurants.

Where data was not available or could not be determined during the consultation, indirect methods or industry averages were used to distribute these costs to activities.

Providing tools and support to assist wineries in building knowledge and collecting the right process efficiency data will assist wineries to understand their processes and construct a more accurate model.

Production / Business operation variability

No two wineries in the trial were alike, and this created challenges in comparing and benchmarking wineries against one another. Variations in business operations included:

- Market targets of premium, standard or bulk wine
- Use of basket presses, bag presses and screw presses
- Fermentation performed in rotary tanks, standard tanks, open top fermenters, tubs
- Equipment and site entirely owned, mortgaged or leased
- Refrigeration only used during vintage or throughout the whole year
- Barrel maturation only, tank maturation only and a combination of both
- Use of estate grown fruit, purchased fruit, juice and wine and a mix of all
- Internally owned and operated bottling lines compared with bottling services
- Bottling in glass vs. packaging in cask
- Wine production for own label and wine production for external labels (contract wine making)
- The cost of ancillary services (cellar door, function rooms, retreats, etc.).

This variation created a level of complexity as the model required some customisation to accommodate these differences. For this reason, the model was created to be flexible enabling each winery to enter data specific to their operations.

Process variability

Some wineries use different methods for a single activity. One example is a winery that used rotary fermenters, open top fermenters and 2,500L tubs for fermentation (Figure 5). Each of these methods consumed significantly different labour hours per tonne of fermentation.

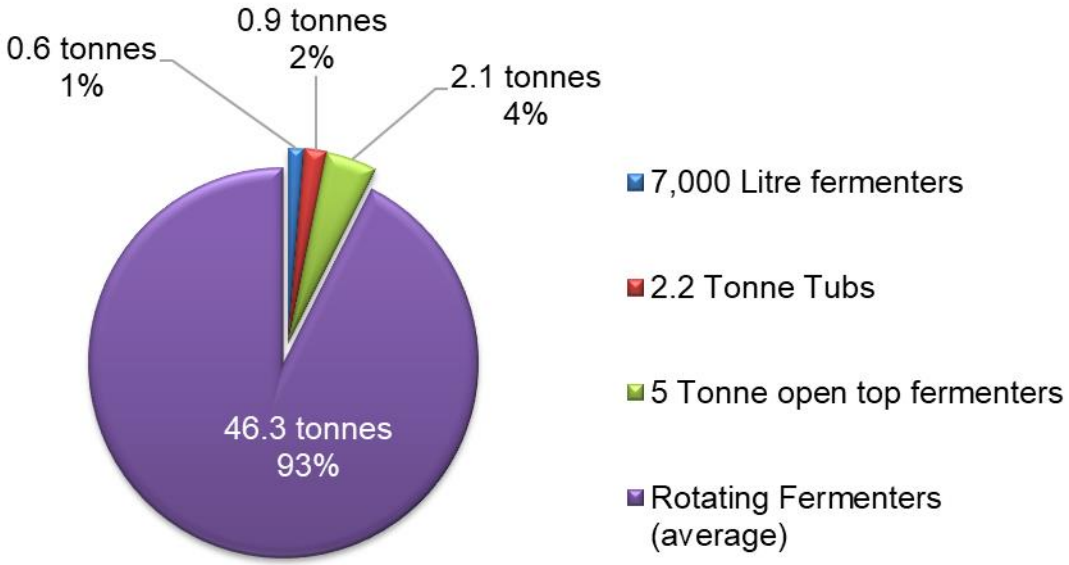


Figure 5: Tonnes fermented per labour hour

To create a comprehensive model of winery functions (and to identify the resource costs incurred by a winery for using various fermentation methods), fermentation would ideally be split into different types of fermentation activities. However, this method would create a significant level of effort by the user to create this level of granularity. For this reason, the tool has been simplified to use average resource costs and productivity measures for each activity.

Overheads

ABC is designed to allocate overheads to an activity. Allocation is not always possible when considering overheads such as administration. Overheads contribute to the overall cost of running a winery, but rationally cannot be readily allocated to a winemaking activity. For example, marketing does not contribute directly to the activity of making wine; however, marketing is needed to sell wine. The strategy (and therefore cost) of marketing can vary as can the success (or failure) of marketing events. For this reason, marketing overheads were excluded from the model. Other overheads included cellar door costs, functions and events, restaurant services, etc.

Winery specific overheads such as administration (including human resources, occupational health and safety, management and accounting), had a more direct relation to the labour costs of running a winery. These overheads have been allocated directly to a new activity (administration).

Boundaries

Given the diverse nature of business models for wineries, the ABC tool will be limited to grape/wine receival and finished wine ready for packing, bulk transport, etc. This tool will not include packaging due to the diversity of these functions.

Any ancillary services not associated with wine production have been excluded from the tool including cellar door and hospitality functions. In some instances, these values may not be able to be separated from winery activities and allocation estimates will be used.

Interface development

Inputs

Input source evaluation

As part of the iterative process of model development, each resource input was evaluated to understand if:

1. Input data is readily available or if it would require additional effort to collect
2. What the likely source for this information would be
3. If the data would require any additional processing before it was entered using the ABC tool
4. The specific information required to capture these input parameters
5. How challenging it would be to allocate these resources to an activity.

The results from this analysis is located in appendix 5.4.

This attachment identifies all potential input needs, their availability, and if any additional processing is required to capture this data

Initially, it was thought that most wineries would have high levels of key process parameters readily available as a key aspect for winery operations (e.g. labour hours, water used, production volumes, electricity quantity, etc). As trials progressed, 2XE determined that wineries with this level of data were the outliers and most wineries had little or no input or resource costs readily available despite an overall strong desire to reduce operating costs.

Due to the scarcity of resource use data, the inputs for the ABC model were significantly reduced compared with the initial scoping. While this reduces the accuracy of ABC models (and limits the level of granularity), it enables wineries to build a macro level ABC model to provide indicative values about which activities consume the highest quantities of resources.

Input List

Based on the availability of information, the following inputs were chosen for the ABC Tool.

- Grapes – $ and Tonnage
- Wine – Production Volume
- Electricity - $ and MWh per annum
- Water - $ and MWh per annum
- Fuel – Type, $ and GJ
- Labour – $ and hours
- Additives – Total costs
- Oak – Total cost and (if available) number of barrels
- Cleaning – Total cost
- Annual depreciation – Total cost

Variability of input scope

For wineries to benchmark against each other, it is important that the same parameters for resources are chosen. In an ideal scenario, the labour cost and hours associated directly with making wine (e.g. cellar staff, winemaking staff, etc), would provide an ideal correlation with the quantity of wine produced. However, in real life examples, the labour needed to make wine may include cellar and winemaking staff in addition to marketing bodies, administration costs, maintenance costs, lab staff, director / owner fees, etc.

This creates significant variability for labour costs per kL of wine produced and decreases correlation when comparing different wineries. Despite this, labour is the second highest production cost for any winery (after grapes) and does need to be considered when identifying process optimisation improvements even for internal benchmarking functions.

Winery business types

There are many different types of winery models each with different cost profiles. Key variables have been included below.

Inputs into the winery

1. Red vs white grapes
2. % of Grapes to Wine
3. % of juice to wine
4. % of finished wine %

Production ownership

1. Contract %
2. Own label %

Wine output

1. Bulk
2. Bottle packaging
3. Other packaging

Storage time

1. White (months)
2. Red (months)

Initially the ABC Tool was setup to allow segregation into different operating models and provide benchmarking for specific winery business types. However, this created a level of complexity for wineries to enter information and allocate these resources to a specific activity. This reduces the likelihood that wineries would use the tool.

Based on trials, the scope of the data used in the ABC Tool was reduced to encourage wineries to complete a basic ABC model. Information about the winery business type was recorded, but not used for any calculation functions in the ABC Tool.

Activities

Activities within a business are the primary drivers of cost. Based on initial scoping, the following list of activities was chosen that was expected to apply to most wineries.

Initial activities list

1. Scheduling
2. Receival / weighing / sampling / classification
3. Receival / hopper / crushing & chilling
4. Pressing (drain and press) (white only)
   - 4.1. Basket press
   - 4.2. Membrane bag press
   - 4.3. Continuous press
5. Clarification (white only)
   - 5.1. Centrifuge
   - 5.2. Floatation
   - 5.3. Cold settling
   - 5.4. RV lees
6. Fermentation & temperature control
   - 6.1.1. Vinimatic
   - 6.1.2. Open fermenter
   - 6.1.3. Tank
   - 6.1.4. Pump over
   - 6.1.5. Wooden fermenters
7. Pressing (drain and press) (red only)
   - 7.1. Basket press
   - 7.2. Membrane bag press
   - 7.3. Continuous press
8. Racking / centrifuge
9. MLF (red only)
10. Clarification (red and white process joins)
    - 10.1. Racking
    - 10.2. Centrifuge
    - 10.3. Xflow
    - 10.4. Floatation
    - 10.5. Cartridge / membrane filtration
    - 10.6. RDV
    - 10.7. Earth filtration
    - 10.8. Cold stabilisation (chilling)
11. Storage tank - blending (temperature control storage)
12. Barrelling ((temperature control storage)
13. Storage tank – blended (temperature control storage)
14. Filtration
    - 14.1. Xflow
    - 14.2. Earth filter
15. Storage tank - finished wine (temperature control storage)

As a result of trials with wineries, this initial list was found to be too extensive by participants. The data entry and allocation of resources to activities was either too time consuming, or, trial wineries did not have the data needed to accurately allocate costs against activities.

For the above reasons, a simplified activity list was developed to accommodate general data, and to reduce the time taken for data entry.

Final activities list

1. Scheduling
2. Crushing
3. Clarification (pre-ferment)
4. Fermentation
5. Pressing
6. Clarification (post-ferment)
7. Storage (tank)
8. Barreling (rack and return)
9. Filtration
10. Cold Stabilisation
11. Cleaning
12. Administration

Based of feedback from trial wineries, this list was easier for wineries to use.

Outputs and Reports

Overview

A key focus of the ABC Tool is to provide a mechanism to enable wineries to change processes or activities in their operations and educate winery staff on winery operating costs. By making these changes, wineries can increase productivity while decreasing operating costs and enable the long-term sustainability the business.

To maximise the usefulness of the tool, it is critical that process efficiency and operational performance information is displayed in an easy to use format.

The manipulation of data once in the database is simple, however, creating reports that provide wineries with the information needed to improve processes takes some planning.

The following section outlines the types of output and reports used in the tool. These reports are based on feedback from trial wineries.

Report objectives

In general, the outputs are used to:

- Provide **resource performance** metrics
- Provide **visual information** to show which activities drive costs and where resources are used
- Provide **benchmarking data** to compare year on year performance, or performance compared with similar wineries

Basic resource performance reports

The basic data entry of production volumes, resource use and resource cost can provide low level business metrics. An example is included in Table 2 that outlines basic input data for the ABC Tool.

Table 2: Basic production and resource data

Tonnes of grapes	kL of wine	Wine conversion (litres per tonne)
12,000	8,900	742
	Cost	**Units**
Grapes	$12,300,000	12,000 tonnes
Electricity	$245,000	1,200,000 kWh
Water	$21,000	18,500 kL
LPG	$6,000	4,500 L
Natural Gas	$6,250	4,250 GJ
Diesel	$2,500	2,000 L
Labour	$1,205,000	32,650 hours
Additives	$218,000	
Depreciation	$524,000	

Using this basic input, the 'cost per unit' can be calculated (Table 3). This provides the winery with basic resource cost business metrics. This type of information can be used as both an internal and external benchmark to compare the costs of resources. For example, a cost of ~$204 / MWh (or 20.4c/kWh) is the average price for a winery of this size. In many instances, the cost per unit is outside of the control of wineries and driven by market forces, however, this can still be used to negotiate resource rates (E.g. negotiating the cost of electricity with an energy retailer).

Table 3: Cost per unit business metrics

	Cost	Units	Cost per unit
Grapes	$12,300,000	12,000 tonnes	**$1,025 /Tonne**
Electricity	$245,000	1,200,000 kWh	**$204 /MWh**
Water	$21,000	18,500 kL	**$1.14 / kL**
LPG	$6,000	4,500 L	**$1.33 / L**
Natural Gas	$6,250	4,250 GJ	**$1.47 / GJ**
Diesel	$2,500	2,000 L	**$1.25 / L**
Labour	$1,205,000	32,650 hours	**$36.91 / Hour**
Additives	$218,000		
Depreciation	$524,000		

Many factors will influence the overall cost of wine production; however, a major factor is the quantity of wine produced (or the tonnes of grapes processed) due to economies of scale. One method to 'normalise' both the resource cost and use is to use factors such as litres of wine produced, tonnes of grapes processed, or litres of wine moved (Table 4).

These normalised values can be used to understand resource performance providing basic efficiency measures for the winery to target year on year improvements or compared production metrics with wineries of a similar size. For example, a value of 135kWh per kL of wine produced is far better than the industry average for a winery of this size. In this example, the wineries electricity is supplemented using solar power.

Table 4: Performance metric examples

	Performance Metrics per kL of wine		Performance Metrics per Tonne of Grapes	
	$ / kL wine	**Resources / kL wine**	**$ / T grapes**	**Resources / T grape**
Grapes	$1,382.02	1.35 T grapes	$1,025.00	
Electricity	$27.53	135 kWh	$20.42	100 kWh
Water	$2.36	2.1 kL water	$1.75	1.5 kL water
LPG	$0.67	13 MJ	$0.50	9 MJ
Natural Gas	$0.70	478 MJ	$0.52	354 MJ
Diesel	$0.28	7 MJ	$0.21	5 MJ
Labour	$135.39	3.7 hours	$100.42	2.7 hours
Additives	$24.49		$18.17	
Depreciation	$58.88		$43.67	

Activity Costs Reports

The overall objective for the ABC Tool and Benchmarking database is to help wineries understand which activities are driving costs in their winery. Table 5 is one output from the ABC Tool. This demonstrated that Storage (tank) is the activity that drives most costs on site, therefore, projects aimed at the storage of wine in tanks is likely to yield the greatest operational savings. This table provides an overview on which activities are consuming the most costs but does not describe how these activities are consuming costs. This requires an additional level of reporting.

Table 5: Overall activity cost for the winery

Activity	Cost
Storage (tank)	$2,899,000
Administration	$1,227,000
Cold Stabilisation	$933,000
Cleaning	$708,000
Crushing	$638,000
Pressing	$531,000
Fermentation	$490,000
Clarification (post ferment)	$245,000
Filtration	$240,000
Scheduling	$185,000
Barreling (rack and return)	$139,000
Clarification (juice)	$6,000
Total	**$8,241,000**

Visual Information and reporting levels

An important reporting feature of the ABC tool is the ability to display information in a visual format (to aid the understanding of reports), and the ability to drill down into an activity and provide a greater understanding of costs.

Figure 6 highlights an example of displayed data using a basic pie chart. In this instance, the pie chart is dynamic, meaning that each section can be drilled down further to reveal more information about what makes up these activity costs (Figure 7).

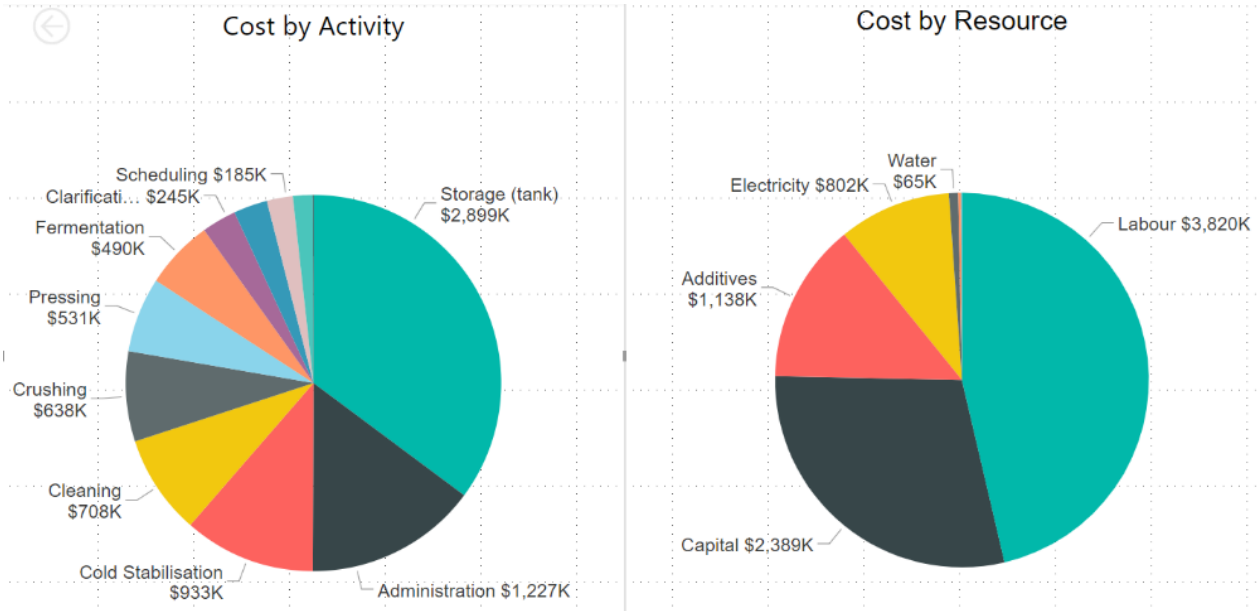


Figure 6: Total activity and resource costs

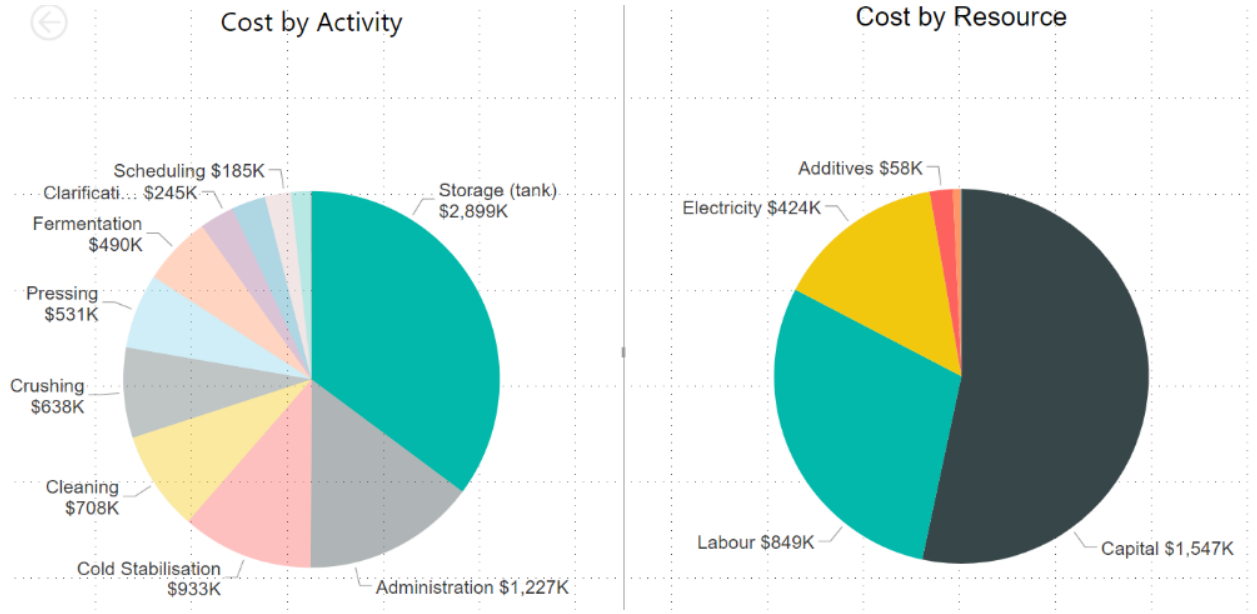


Figure 7: Breakdown of resources consumed by the 'storage' activity

Figure 8 provides an overview of one of the reports from the ABC Tool. This provides a visual tree diagram representation of the cost of each activity. Like the previous example, this report is a dynamic report and can be further broken down to resources (Figure 9). This provides greater insight as to what is driving costs for the winery. In this example, the hypothetical winery is relatively new and capital / depreciation costs contribute the most to the ‘storage’ activity.



Figure 8: Tree diagram of Activity Costs

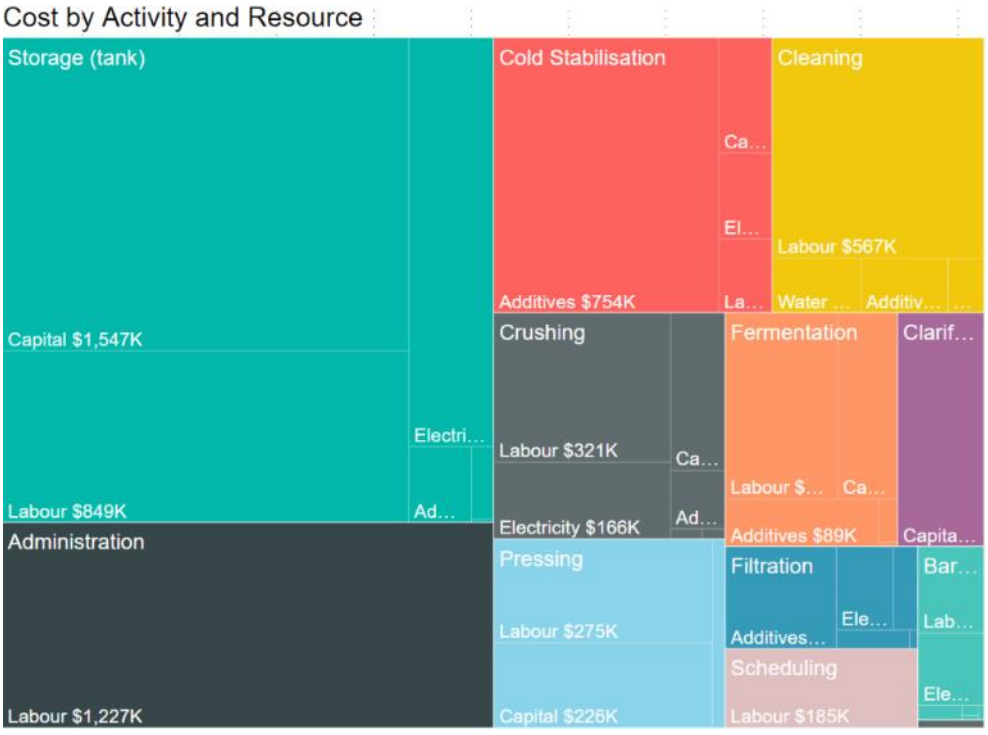


Figure 9: Tree diagram of Activity Costs and Resources

Visual trace of resources to activities

The ABC Tool uses Sankey diagrams to enable users to visually trace where costs are incurred. Figure 10 provides an example of which activities consume Labour costs. In this example, labour is consumed by both administration and storage activities.

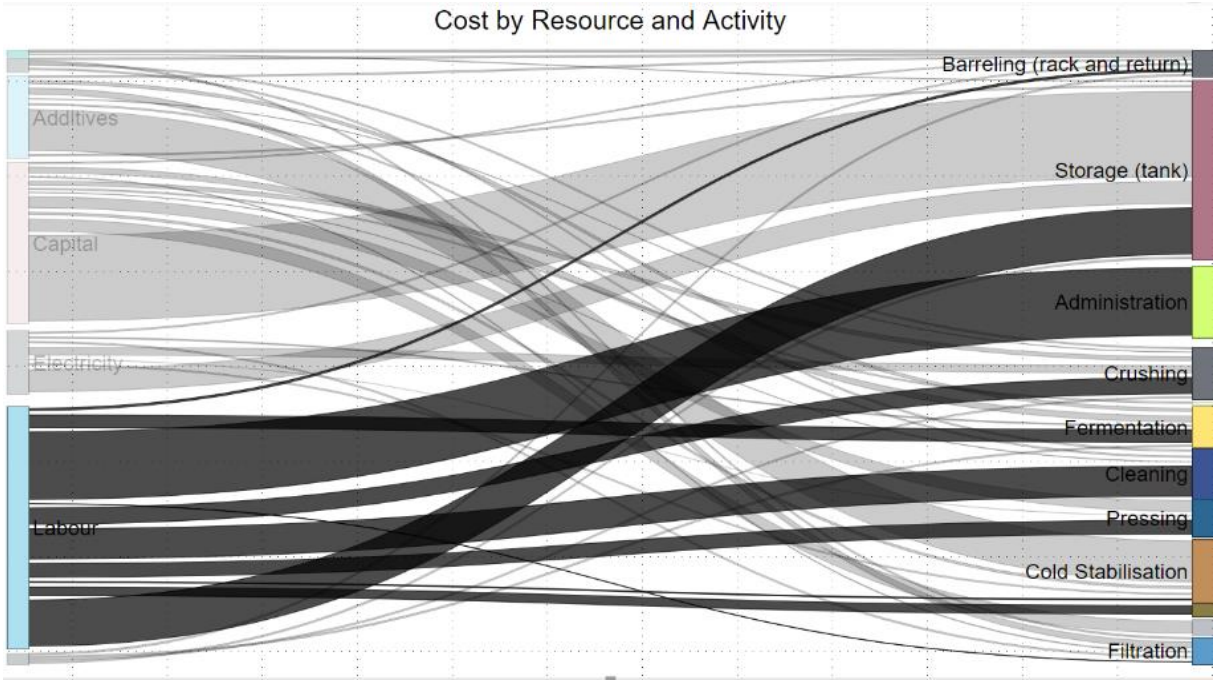


Figure 10: Sankey diagram to trace Labour costs

Using the 'drill down' function, the 'storage' activity consumes labour from cellar staff, winemakers, lab and maintenance staff for wine production. In contrast, the 'administration' activity consumes labour from both administration staff, and 'other' staff (Figure 11). In this example, 'other' may include directors or owner fees.

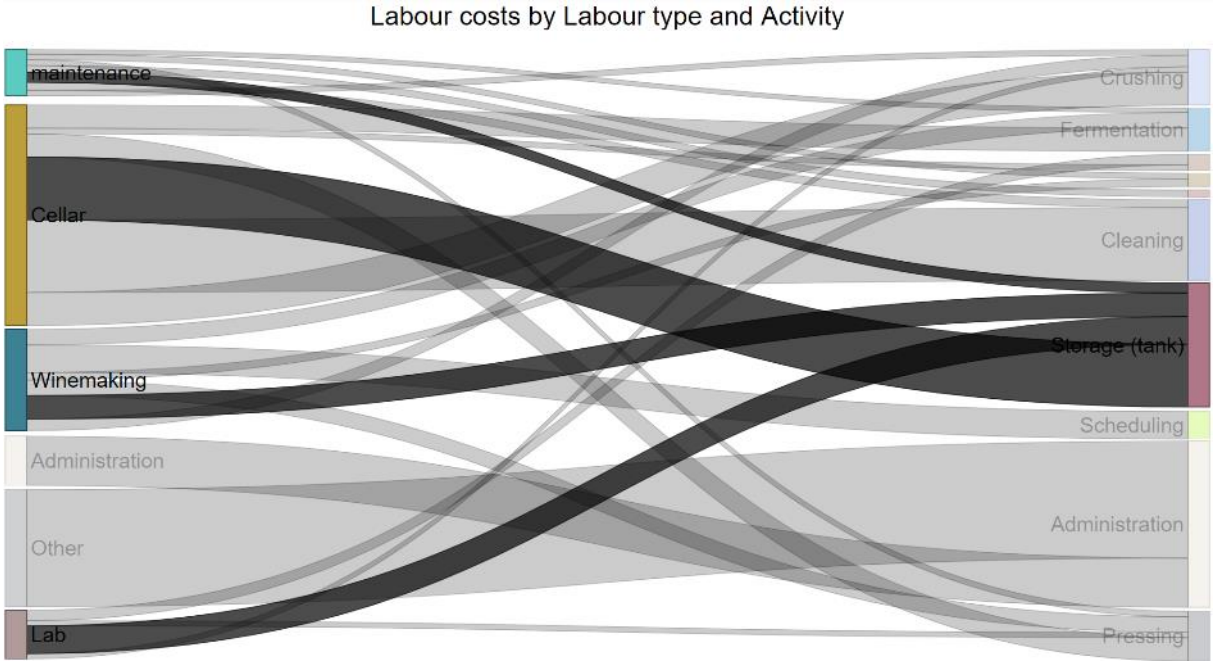


Figure 11: Sankey diagram to trace the type of labour used for activities

The ABC Tool also provides the ability to understand which activities consume the most resources for a given role. In Figure 12, cleaning and tank storage consume the most cellar labour resources. This information may be used to develop the business case for improved cleaning equipment or changes to cleaning regimes to decrease operating costs.

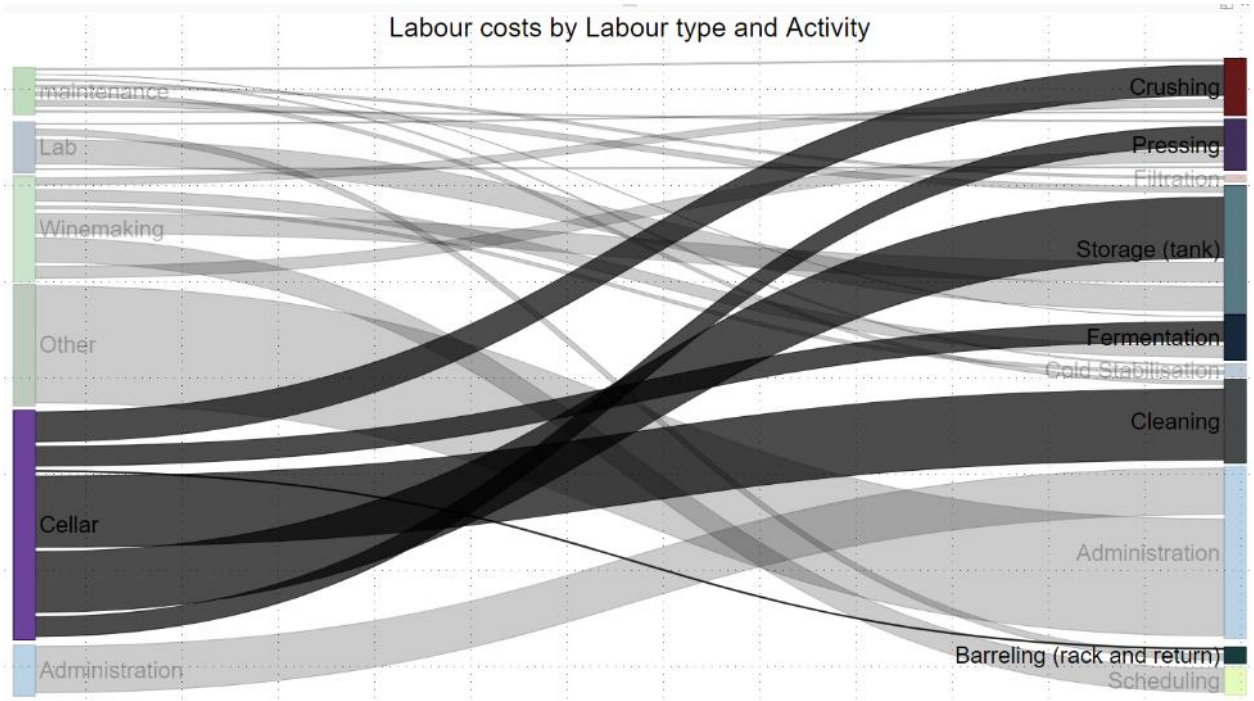


Figure 12: Sankey diagram to identify which activities consume cellar labour

The ABC Tool is multi-staged, in that resources are normally allocated to a sub-class prior to allocating to an activity. For example, using the case of electricity:

- Step 1 – All electricity is allocated to equipment
- Step 2 – All equipment is allocated against an activity.

This means that the ABC Tool reports can be used to trace what equipment is contributing the most to winery costs.

Figure 13 provides an example of equipment running cost reports. In this example, electricity has been allocated against various pieces of winery equipment with refrigeration consuming the most electricity. Refrigeration running costs are then allocated against activities. In this case, the Storage and Crushing activities consume most refrigeration electricity which is expected in this type of winery.

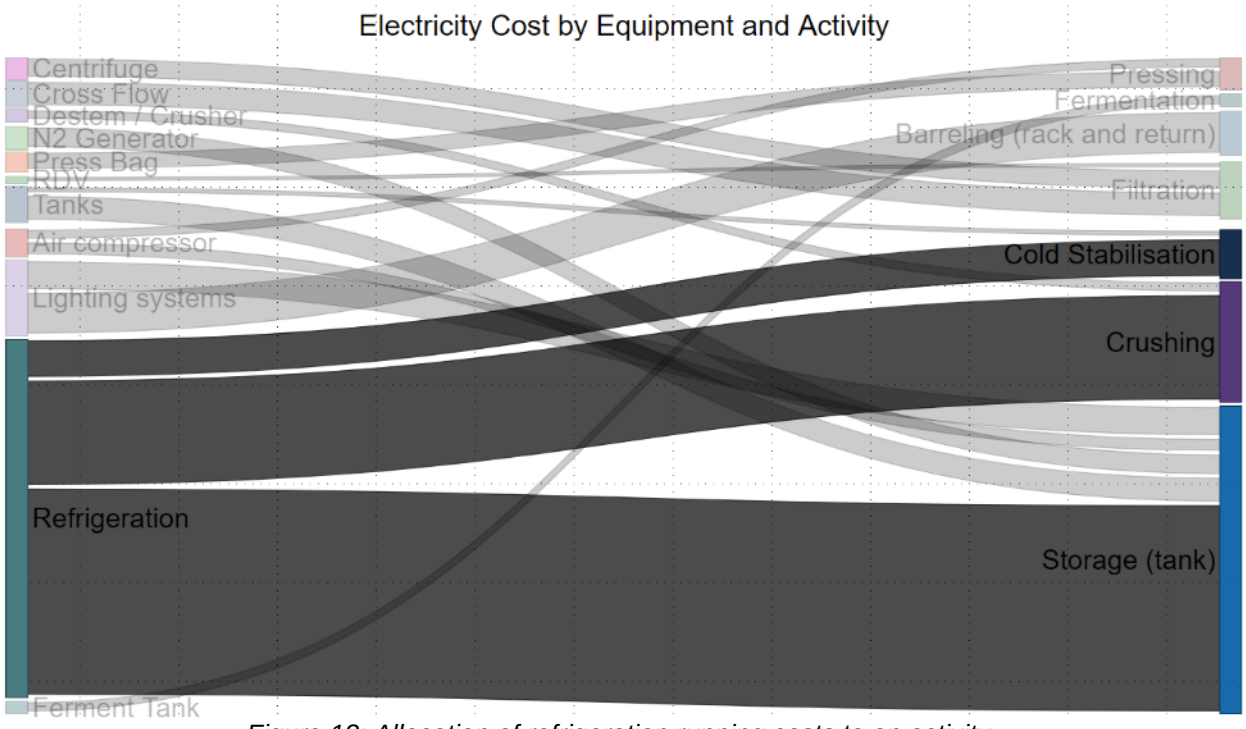


Figure 13: Allocation of refrigeration running costs to an activity

Benchmark Reporting

One feature of the ABC Tool is the ability to benchmark the resource use of similarly sized wineries.

Based on winery data, there is some correlation with winery size and resource use (for labour, electricity, water and fuel use). This enables calculations to be undertaken so a winery can understand their resource performance compared with wineries of a similar production volume.

Figure 14 provides a graphical example of how these benchmarking calculations are determined for electricity. In this example, the electricity productivity rate (i.e. cost of electricity / kL of wine produced), is compared with the volume of wine produced. Based on the logarithmic trendline of these wineries, upper and lower control limits can be calculated using the standard deviation of the trendline calculation range.

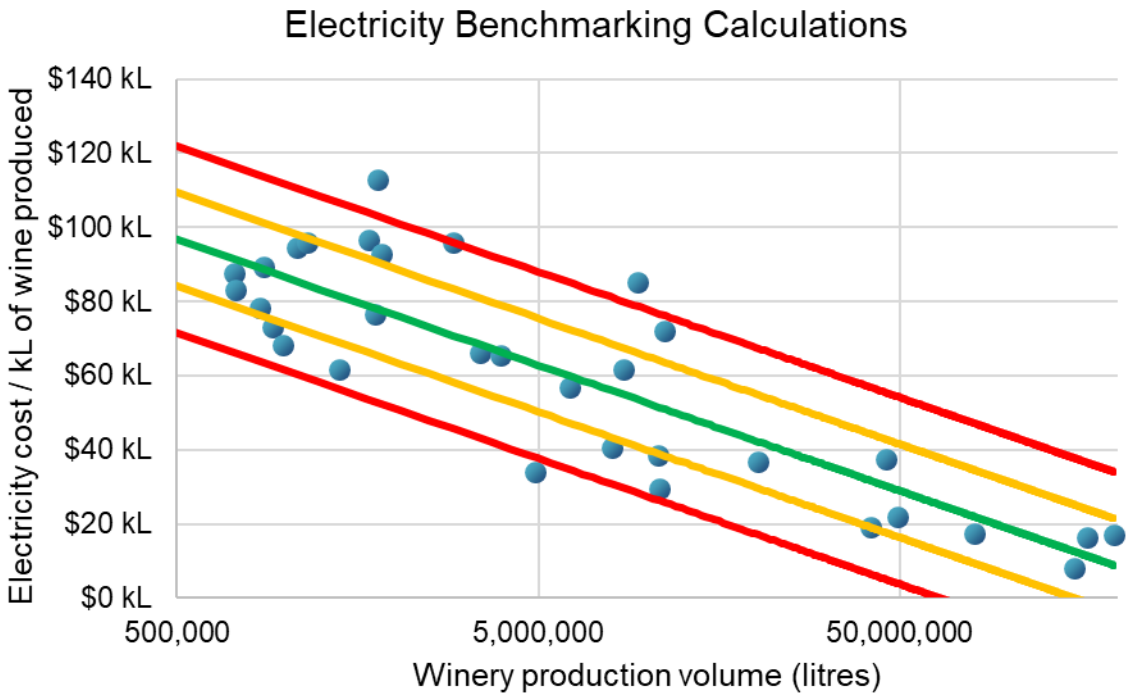


Figure 14: Benchmarking calculations

The graph in Figure 14 is a hypothetical example only and is not based on actual winery data to maintain confidentiality for the purposes of this report. In the ABC Tool, this type of data will not be provided to participants, instead, participating wineries will be provided with a gauge to illustrate their electricity performance compared with similar sized wineries.

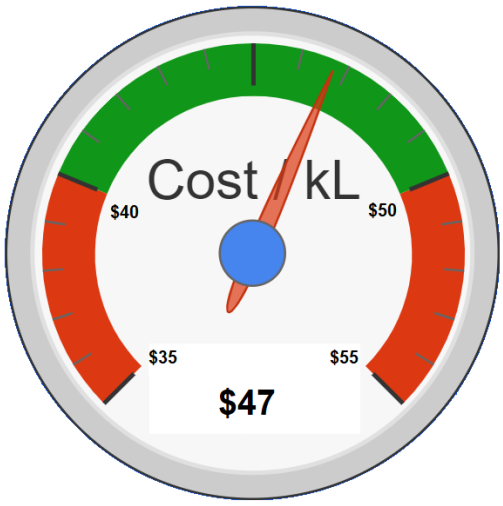


Figure 15: Electricity performance benchmarking gauge

In this example, the winery is using $47 of electricity per kL of wine. The calculated industry average for a winery of this size is ~$45 with upper and lower control limits of $40 and $50 respectively. This provides information to the participating winery that electricity costs are commensurate with a winery of this size.

Platform development

Based on initial trials, a preliminary ABC Tool was developed using MS Word, MS Excel, and Power BI.

MS Word was used to create input templates using a customised questionnaire and form system. This form used a variety of content controls to simplify input data. Once this form was complete, users return the completed form for 2XE to enter into the excel system for calculations. Details of the input interface are in the ‘

Interface development' section of this report.

All results were calculated using MS Excel. This program was chosen as it was thought that most wineries would have access to this program and that it would have the functionality needed to allow easy migration of the inputs sheet, be able to perform the calculations needed to transform data and create populated database tables ready for reporting functions via power BI. The parameters, calculations and specifications are summarised in the 'Core mechanics and allocation' section of this report. Since the beginning of the project, this section of the tool has undergone ~50+ iterations altering fields including inputs, allocation methods, outputs and reports.

Once all data had been entered into the MS Excel database, this data was transformed into visual reports using MS Power BI. Details of the reports are summarised in the Outputs and Reports section of this report.

Issues

During the testing and validation phases, many changes were required to the input interface and excel calculation sections of the ABC Tool. This was done to account for a variation in available data and winery operations as outlined in the Tool reiterations section of the report.

One of the critical issues in the platform development was not knowing how the tool would work until it was tested with a variety of wineries. This meant changes were required on a continual basis as more wineries were engaged. A key function of the ABC Tool was to ensure it could be used by most wineries across Australia. For this reason, effort was spent evolving the tool to find the boundary between flexibility and ease of use compared with the ability to provide a tool that can generate critical information for wineries.

As the Excel version of the Tool was rolled out to more wineries, several issues became apparent:

- Not all wineries had MS Excel or the most recent version of the excel program
- Despite the effort spent in simplifying a model using MS Excel, the model was still not intuitive enough for most wineries
- Wineries did not get results immediately (leading to less motivation to complete the model)
- The system required a lot of work from 2XE staff to migrate data from the input sheets to the excel model.

Migration to a web-based system

Based on the issues listed above, a decision was made to migrate the system to a cloud web-based version. This web-based system could provide all the functionality required by the ABC Tool

while eliminating the shortcomings for the Excel / Power Bi system. The main issue for this type of system is the ongoing fee associated with using any online cloud storage or web hosted system.

Web-based version

A web-based version of the ABC Tool was created (Figure 16) and this is now available for use by wineries across Australia. (https://abc.2xe.com.au/)

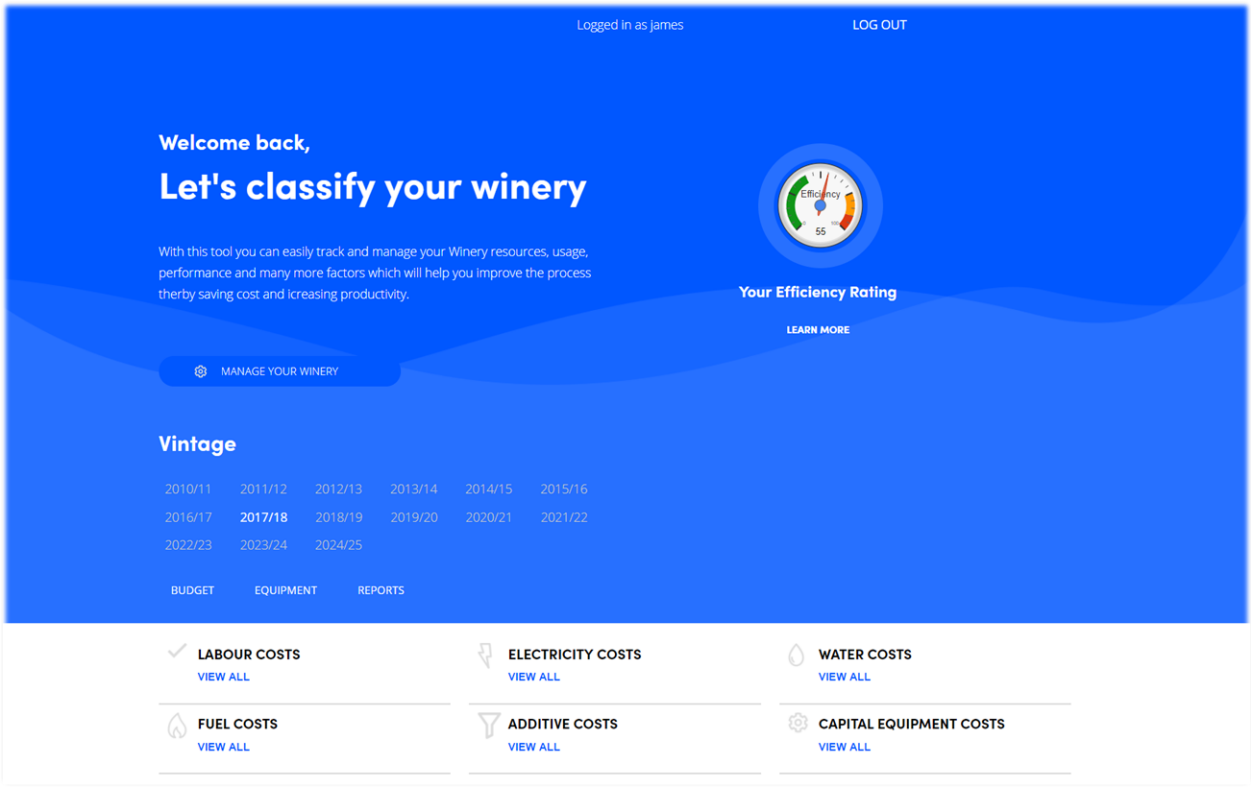


Figure 16: Web-based version of the ABC Tool

The ABC tool uses Amazon Web Services (AWS) system for both the data processing and storage of data. This provides a great deal of flexibility and future proofing given the direction of technology (e.g. potential for machine learning, development of the IoT market and the ability to upload direct from data sources).

The system has high levels of privacy and confidentiality in place. This means only the user can access their own data.

Data entered into the system is automatically used to update the industry performance database by anonymous aggregated data. This allows wineries to immediately understand their performance compared with the industry average and allow wineries to understand their performance when making changes to their own processes. Provisions for automated data vetting (preventing one winery skewing the average database) has been included in the system.

Feedback mechanisms

The web-based version of the tool has been continually updated in terms of the user interface. The objective for this tool is to encourage wineries to enter and allocate data (where available) into the tool. As part of this encouragement, the tool provides measures of performance metrics whenever a user enters data into this tool. This can be in the form of basic metrics (such as the cost off electricity per kWh, or industry performance data such as the cost of electricity per kL of wine produced). The objective for this user interface is to continually provide feedback to the participating winery on an ongoing basis to encourage wineries to obtain and allocate new sources of data. This is an important step for wineries to use evidence-based data for decision making, leading to more efficient practices.

Phase 3: Rollout and Extension

Overview

This phase summarises the rollout and extension pathway for the project including:

- Evaluation of the benchmarking database
- Development of extension materials (e.g., how the use the model)
- Public release of the ABC Tool and delivery to the industry

Evaluation of the database

All information entered by wineries is stored in the cloud-based database. This provides the ability to generate industry wide performance data. As more wineries use the ABC Tool, the database will provide more accurate industry results.

Currently, most data is stored on an external excel system for evaluation purposes. This provides insight into industry wide performance and allows the industry as a whole to understand where efforts need to be focused to manage winery operating costs.

Figure 17 provides an example of the industry performance for electricity. This example provides a range of electricity costs per kL of wine produced. In this example the range of costs are visually represented, and control limits are included to indicate where a winery is using more or less than the expected electricity rate.

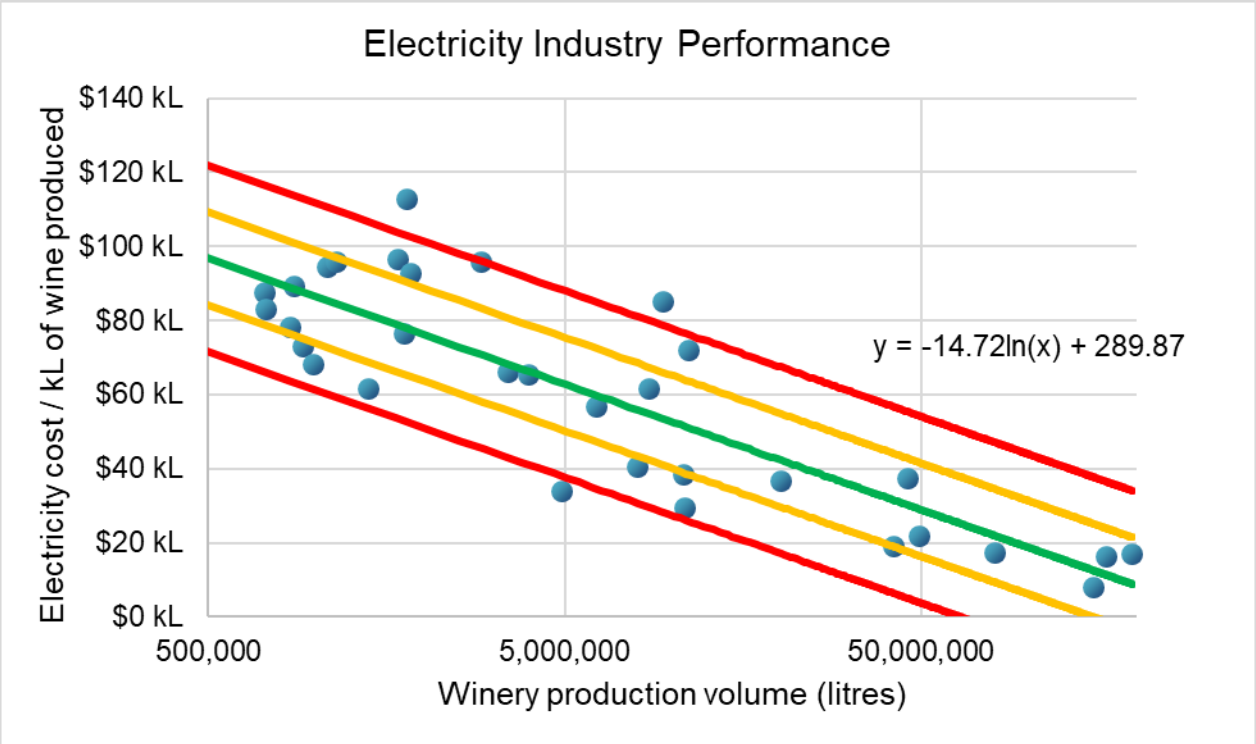


Figure 17: Industry benchmarking performance (electricity)

Figure 18 provides a similar example of industry performance for electricity use rather than cost. In this case, 'electricity use' is a better metric as it removes the variability associated with different electricity pricing structures. In this example, wineries that are lower than the industry average have solar systems installed thereby decreasing the quantity of grid electricity used. Likewise, wineries that are above the industry average may not have the ability to isolate winery functions from other high energy use systems such as hospitality functions or, more likely, the energy associated with bottling lines, energy intensive wastewater systems, etc.

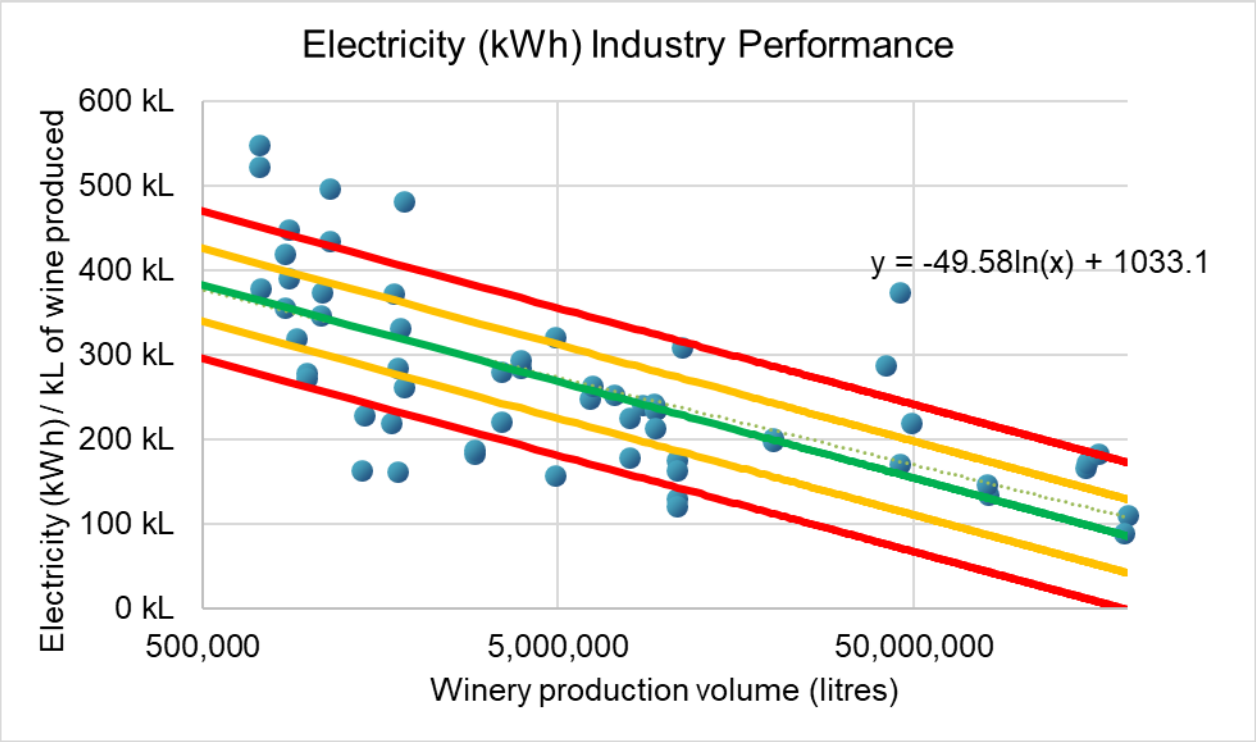


Figure 18: Industry benchmarking performance (electricity kWh)

Outlier determination

The level of accuracy for the database is dependent on the level of accuracy of winery data. In cases where wineries are unable to separate winemaking functions from other functions (e.g. water for use in the winery versus water used in irrigating vineyards), the data can become skewed. In any future versions of the ABC Tool, specific instructions as to 'how and what' to measure are included as part of the user interface. This will help maintain the accuracy of the benchmarking platform without the need for constant data cleansing.

Extension material

Initially, this project had provision for guides or instructional videos about how to use the ABC Tool. After discussions with Wine Australia a decision was made to invest more resources into developing a user friendly and intuitive web-based model (avoiding the need for user material) and reduce the time spent on the development of ABC guides and instructional information.

Industry Delivery

The web-based version of the ABC Tool is now available for public use. Several case studies have been developed illustrating how businesses have used the tool for internal and external benchmarking and understanding the cost drivers of various core winemaking activities (Appendix 1.8).

Outcome/Conclusions

Despite the challenges faced in crating the ABC Tool, the project has resulted in the delivery of a user-friendly ABC Tool that wineries can used for decision making and industry benchmarking. The delivery of the ABC tool and benchmarking database can now be used to deliver data-driven, evidence-based value to the Australian wine industry in several different ways:

- It provides wineries with fundamental new knowledge and capacity to assess their production costs, target improvements towards processes, activities and products that achieve the greatest improvements in efficiency and profitability
- It provides the Australian wine industry with the means to benchmark its cost-of-production performance against domestic industry averages, thereby contributing to industry intelligence
- It provides a modelling platform to test the impact of future R&D projects (e.g. those funded or delivered by Wine Australia) on the impact of winery production costs.

Overall findings

Based on the data available from participating wineries, one of the key findings is that the wine industry still has limited production data and a limited understanding about how and where costs and resources are incurred in their winery. This is both from an accounting and process control perspective.

Many wineries had an inability to acquire core resource information (e.g. electricity and water bills are paid and forgotten about) or identify where resources were used in the winery (e.g. the cost of refrigeration, where fuels are used, etc.).

For some wineries, this information was captured, however, was compartmentalized and available to a select few in the organization. Ensuring this core information is both captured and presented to staff in a meaningful way is a core step for wineries to increase accountability for resource use and manage operating costs.

Previous projects have compared wineries to other beverage manufacturing industries. A core difference is that wine making is characterised by a primary feedstock (grapes) that have a short shelf life and vary greatly from year to year in terms of quality, volume and variety. This means wineries tend to be at the mercy of their feedstock more than many other industries. The result of this is that wineries need to be flexible, and in the absence of certainty, wineries have tended to rely on guesswork rather than evidence-based decision making. Despite this historical paradigm, data capture and interpretation are still a critical step for wineries in terms of managing costs and operational improvements.

Industry 4.0 and automation of data collection

The growth of Industry 4.0 over the past fives years and expected future growth has resulted in a stream of inexpensive sensors and data management platforms for a variety of businesses. Increasingly, sensors and data platforms are transforming a previous month-long task of collecting data for decision making into the click of a mouse button. The range of wireless sensors means installation times and costs are greatly reduced. Wireless sensors can be applied to all aspects of a winery operation to record:

- How much hot water is used and when it is used
- How much electricity the refrigeration system is using
- How much water is used for cleaning and how much for irrigation
- How much electricity is used to cool barrel rooms

Collecting this data is the first step for wineries to understand and manage costs in their winery (and what projects will improve winery costs the most).

Recommendations

The ABC Tool can provide long term data-driven, evidence-based value to the Australian wine industry. Several steps are required to ensure the ABC tool is utilised to its full potential and can act as a catalyst to drive operational improvements and decision making in the wine industry.

Ongoing marketing and engagement

The benchmark section of the ABC tool is currently populated with 30+ wineries. As more wineries make use of this tool, the number of data sets will increase as will the accuracy of the industry benchmarking figures. For this reason, 2XE recommends Wine Australia continue to promote the ABC tool to Australian wineries. This will enable more wineries to understand their performance compared with the industry average and will improve the accuracy of the industry average.

Given the vintage variability in the Australian climate, benchmarking values are only comparable on a 'per vintage' basis. Without an annual benchmark the financial benefits of any winery operational improvement project cannot be validated. For this reason, 2XE recommends Wine Australia continue to run this program annually to provide wineries with an ongoing collaborative benchmarking system. This will require Wine Australia to dedicate some internal resources to prompt wineries to use the ABC Tool.

Hosting

The ABC Tool is a web-based tool and requires a small monthly fee for webhosting, cloud database hosting and website maintenance. 2XE has contracted a 3rd party service provider for both the development and maintenance of the ABC Tool. 2XE is currently financing the upkeep of this tool as part of the ABC Project. For the ABC Tool to remain live and act as a long-term platform for the wine industry, 2XE recommends Wine Australia transfer the contract with the 3rd Party web maintenance team from 2XE to Wine Australia.

ABC Tool improvements

The ABC Tool has been created largely to help drive data-based decision making and to encourage wineries to collect pertinent operating information. A key feature is the user friendliness, ease of data entry and simplicity of functionality. In an aim to successfully deliver these features, many of the more complicated parameters were omitted from the final model as wineries could not readily access this data. However, in the future as performance data becomes more readily available to wineries, additional benchmarking parameters can be included to further assist wineries understand and improve their performance. An example of these benchmarking parameters for electricity is included in Table 6.

Table 6: Future performance benchmarking metrics

Performance Metric	The purpose of this metric
c/kWh, peak, off peak	Allow wineries to understand their retail electricity rates and negotiate with retailers to secure better contracts with their energy retailers
Grid, solar generation, total use (MWh pa)	Most wineries with solar systems installed do not have a good understanding about their total electricity use (as their solar system offsets any grid electricity purchased). For this reason, solar systems may mask any inefficient electricity practices on site. The addition of three fields: Grid, Solar generation and Solar export per annum will allow wineries to understand their Total electricity use (independent of any solar systems). This has two benefits for benchmarking as it allows the comparison of all wineries on a level playing field, and it allows wineries to determine if demand side electricity issues need to be improved.
Max Demand	This allows wineries to understand the maximum electricity demand of their winery. This leads to projects to improve demand strategies such as moving refrigeration use to off peak times.

Appendix 1: Communication

The following section lists the communication material used for winery recruitment

- Appendix 1.1 – ABC Explained Flyer
- Appendix 1.2 – ABC Tool presentation
- Appendix 1.3 – Non- disclosure agreement
- Appendix 1.4 – Initial data collection form
- Appendix 1.5 – Revised data collection form (Part 1)
- Appendix 1.6 – Revised data collection form (Part 2)
- Appendix 1.7 – Classification of winery participants (anonymous)
- Appendix 1.8 – Case studies

Appendix 2 Intellectual Property

Identify the intellectual property and/or valuable information arising from the research.

A considerable quantity of valuable information will be generated from this project. It is out intent that anonymous aggregated industry average data is communicated to Wine Australia as participant numbers increase. This will provide Wine Australia with the knowledge of core issues facing the wine industry.

Appendix 3: References

Life cycle cost analysis of wine processing (2XE 1301).

Appendix 4: Staff List

This project has largely been driven by 2XE and the Chief Investigator, James McIntyre with the support of 2XE Staff including

- Chief Investigator – James McIntyre
- Client Liaison – Edward Juers
- Project supervisor – Nick Palousis
- Investigator – Steve Szyndler
- Data Analyst – Anna Pfarr

2XE would like to thank JP Media for converting the ABC tool into a web-based system. In particular,

- Jassa Amir-Lang
- Patrick Anderson
- Nathan Pana
- Josh Millard

2XE would like to thank the ABC steering committee including:

- Denise D'Souza
- Luke Wilson
- Mel Reddaway
- Trevor Davidson
- Nick Morrow
- Bryn Richards
- Bruce Ludewigs
- Megan Coles
- Tim Hackett
- Julie Montgomery

Appendix 5: Additional information

- Appendix 5.1 - Steering Committee Recommendations.docx
- Appendix 5.2 - Entwine review.docx
- Appendix 5.3 - Resource Data Evaluation.xlsx
- Appendix 5.4 - ABC Tool website hosting and maintenance costs.