Vegetable Industry Development-Bridging Project

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Project Number: VG11038

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(15 March 2013)

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This report provides the details of the work undertaken by AUSVEG in the industry development bridging project and the recommendations for future industry development in the vegetable industry.

The research contained in this report was funded by Horticulture Australia Ltd using the National Vegetable Levy and matched funds from the Australia Government.

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1.0 Summary

The Vegetable Industry Development Bridging Project was contracted by HAL to the National Peak Industry Body, AUSVEG, in mid-2012 following the conclusion of the Vegetable Industry Development Program (VIDP). The objective of the Bridging Project was to investigate the most effective future structure and model of delivery for industry development activities within the vegetable industry.

The Bridging Project enabled AUSVEG to coordinate an evaluation of industry development needs, taking into account previous reviews of industry development programs, namely the Consulting and Implementation Services (CIS) review of the VIDP setup by HAL in late 2011.

As part of the Bridging Project, AUSVEG's main objective was to develop a three-year project proposal, working closely with HAL, for a revamped and more cost-effective vegetable industry development project, whilst at the same time conducting a number of scoping studies that would be used to inform future 'Drive Train' R&D under the new Vegetable Industry Strategic Investment Plan 2012-17. The new project was to build upon those elements of the previous project that were deemed worth continuing, but via a consolidated and more cost-effective structure.

The main output of the Bridging Project was the three-year project proposal for the new industry development project. The Bridging Project has enabled AUSVEG and HAL to review the recommendations from the independent review of the VIDP conducted by CIS, but more importantly it has also allowed time for AUSVEG and HAL to determine the optimal structure for industry development services in the vegetable industry, based around the key criteria of value and effectiveness. This optimal structure is explained in detail in the new three-year project proposal.

In its report to HAL submitted in August 2011, CIS had concluded that:

> *"Future extension capabilities should comprise of no more than 5 sub programs with clearly defined scope and minimal redundancy. Reduced lines of reporting, increased communication flows, and optimal outputs will be achieved with a simplified structure of service providers organised by function rather than topic."*

The Bridging Project was therefore commissioned by HAL with these findings regarding the previous VIDP in mind and the three-year project proposal is reflective of the stated objective of a much simpler structure.

Furthermore, the new three-year project also reinforces the finding of CIS that:

> *"Any future extension related programs of this nature should be managed by the Peak Industry Body and oversight should be provided by HAL."*

The new three-year project was designed in the knowledge that any new industry development project would need to deliver tangible and relevant outcomes for Australian vegetable levy payers, but under a different framework to that which had been utilised previously. During the Bridging Project, AUSVEG worked hand-in-hand with HAL in developing components for the new three-year project to ensure that the project would meet these criteria. The Knowledge Management component of the previous industry development program was trialled within AUSVEG during the Bridging Project and by enlisting appropriate expertise AUSVEG was able to make significant improvements to the existing Knowledge Management framework, making it more user-friendly and accessible for growers.

During the Bridging Project, AUSVEG also coordinated significant scoping studies into two key areas: the skills and training needs of vegetable growers and data requirements for the vegetable industry.

Tender processes to create a project to monitor consumer behaviour / provide market insights to growers and to trial a 1800 Agronomist service (as discussed by the Vegetable IAC) were also undertaken.

The new structure suggested in the three-year proposal takes into account the previous recommendations made in relation to the VIDP by CIS, as well as the findings from the investigations undertaken during the Bridging Project itself.

Final reports on the two scoping studies that were conducted in the Bridging Project (the National Skills and Training Scoping Study and the Review of data requirements for the vegetable industry) are included in this report as Appendices 1 and 2 respectively.

2.0 Introduction

The Vegetable Industry Development Bridging Project (27 June 2012 – 17 March 2013) has investigated the following in relation to the Australian vegetable industry:

- The most effective structure and model of delivery for industry development over the next three years.
- A more focused cost-effective model for knowledge transfer leveraging from the existing Knowledge Management system which has been evaluated and improved during the project timeframe.
- Skills and training needs within the industry, in the form of a National Skills and Training Scoping Study that was sub-contracted by AUSVEG to Tasmanian-based agricultural consultancy Macquarie Franklin with oversight provided by AUSVEG.
- Potential service providers and budgetary requirements for a new Consumers & Markets sub-program, with more flexibility and the capacity to provide custom reporting on topical or emerging issues of relevance to levy payers (e.g. changes in pricing).
- The most effective means of managing the industry's Knowledge Management System, promoting access to R&D contained within it, and the resources required to achieve this.
- The need for an economic / policy capacity within the vegetable industry to provide data, analysis and address policy issues associated with R&D on a more cost-effective basis and the benefits that might flow from an increased capacity in this area.
- Agronomic service providers in regards to the feasibility of a 1800 Agronomy service for levy payers. AUSVEG coordinated a tender process in conjunction with HAL, after which HAL convened an independent panel to review the tenders received.
- Domestic and international data requirements within the vegetable industry, by way of an independent review completed by statistical consultant Dr Ben O'Neill.

The overall aim of the Bridging Project was to produce a project proposal for a new three-year industry development project that is reflective of industry needs and will build upon previous investment in this area. Concurrently, the Bridging Project enabled significant scoping studies to occur in the areas of skills and training and data requirements for the industry, which are two important areas for future investment if the industry is meet the objectives of the recently endorsed Vegetable Industry Strategic Investment Plan 2012-2017.

3.0 Method and activities

This section outlines the methods that were utilised to investigate the future structure for industry development, as well as undertake the scoping studies into skills and training needs and data requirements within the vegetable industry.

A list of key activities/outputs is provided below in order to illustrate the work undertaken on the project, however, further detail explaining the methodology and the activities/outputs completed is provided in Sections 3.1 to 3.7.

Key activities/outputs:

- A list of potential service providers for the National Skills and Training Scoping Study was produced by AUSVEG and approved by HAL.
- A brief for National Skills and Training Scoping Study was written by AUSVEG and approved by HAL.
- The tender process for the National Skills and Training Scoping Study was coordinated by AUSVEG in conjunction with HAL.
- The National Skills and Training Scoping Study was undertaken by Tasmanian-based agricultural consultancy, Macquarie Franklin, under the management of AUSVEG.
- The National Skills and Training Scoping Study was promoted widely by AUSVEG within the vegetable industry via a range of communication channels, including Vegetables Australia and the AUSVEG Weekly Update.
- Following face-to-face and phone interviews around Australia and a comprehensive desktop study, findings from the National Skills and Training Scoping Study were finalised and presented to HAL and members of the Vegetable Industry Advisory Committee. AUSVEG provided ongoing guidance throughout each phase of the project.
- A range of recommendations relating to the National Skills and Training Scoping Study were tabled by AUSVEG in its final report so they could be considered by the Vegetable Industry Design Teams at the next series of meetings in May 2013.
- A brief for a Review of data requirements for the vegetable industry was written by AUSVEG and approved by HAL.
- Statistical consultant Dr Ben O'Neill was engaged to complete the Review of data requirements for the vegetable industry and make recommendations regarding how the vegetable industry could better meet levy payers' and the industry's needs in regards to quality, accuracy and relevance.
- A final report on the Review of data requirements for the vegetable industry was written by Dr O'Neill and presented to HAL and the members of the Vegetable IAC for their consideration. A number of findings from the study have already been actioned whilst others are proposed to be actioned during the next industry development project.
- A review of the existing Knowledge Management System was completed by AUSVEG and a range of significant improvements were made to make the system more user-friendly and improve functionality (refer to section 3.5 below).
- Ongoing updates to the National R&D Database were completed, including uploading new HAL final reports once they were approved. Pages on the Knowledge Management System were maintained as needed.
- Two discussion papers (one on import data and the implications for the Australian vegetable industry and one on issues drawn from the 2012 ABARES survey) were written by IDEA and published on the AUSVEG website.
- Two articles on relevant economic topics were written by IDEA and published in the September and November 2012 editions of Vegetables Australia (one on new data from the

2011 agricultural census and one evaluating the seriousness of the threat from the Chinese vegetable industry).

- Two training sessions were held at the AUSVEG offices where IDEA trained AUSVEG staff on how to access data through the Global Trade Atlas service and the ABS and ABARES websites.
- An article was published in Vegetables Australia in September 2012 updating levy payers on the National Skills and Training Scoping Study and encouraging levy payers to get involved.
- An investigation was conducted into the feasibility of a 1800 Agronomist service- initially this involved phone calls to a range of service providers to ascertain whether the service would be feasible; secondly, a tender process was coordinated by AUSVEG in conjunction with HAL and tenders were reviewed by an independent panel convened by HAL (not including AUSVEG).
- Phone interviews were conducted with each of the Consumers and Markets service providers that tendered for the proposed project and the responses to interview questions informed the selection process with regards to selecting a preferred project proposal for submission to the Vegetable IAC from those that had tendered. It was agreed with HAL that audio of interviews would not be released as it contained confidential information.
- A list of recommendations was produced in regards to future industry development activities (refer to the Recommendations section of this report).

- 3.1 National Skills and Training Scoping Study

The aim of the National Skills and Training Scoping Study was to identify the skills that need development to advance the vegetable industry. A result of determining the skills in need of development could be future investment in training and skills programs in these areas through the Vegetable R&D program.

The study was to, through a desktop study, survey and qualitative interviews, determine the highest priorities for the industry in respect of training to address deficiencies in the skill base. An emphasis was to be placed on those areas that may be improved in order to have the greatest possible impact.

For example, training may be required in business management or in more practical on-farm skills such as spraying, harvester use etc. As this study required specialist expertise a range of companies with expertise in skills and training related work were approached to tender for the project, with the approval of HAL. Each company was provided with a copy of a project brief and asked to respond to the brief by providing a project proposal that would meet each of the industry's requirements.

With HAL's approval, Tasmanian-based agricultural consultancy Macquarie Franklin was sub-contracted by AUSVEG to undertake the National Skills and Training Scoping Study. The study involved the completion of a desktop study and then a series of face-to-face and telephone interviews around Australia, with AUSVEG providing input into the key vegetable growing areas and methods of communication with growers. AUSVEG publicised the study widely in Vegetables Australia magazine and via electronic media such as the Weekly Update.

The results of the study have been documented in Macquarie Franklin's final report (Appendix 1) and the Desktop Review (Appendix 4). These comprehensive reports provide detailed findings on the areas of training and skills development that should be addressed by the industry. The top 8 areas identified for consideration and the relevant page numbers in Appendix 1 are:

- 3.2 Review of Data requirements for the vegetable industry

A review by an independent consultancy was commissioned to conduct an analysis and make recommendations in relation to the domestic and international data requirements of the vegetable industry. The review would include recommendations in relation to the 'best' sources to access industry data and statistics (such as trade, production, import/export and financial performance of vegetable growers)- including a review of existing sources – and would consider any options to improve the accuracy and relevance of the data that is currently being provided (such as through different data types, larger sample sizes etc), as well as potential additional sources for statistics/data (if applicable), and any cost implications.

The Review of data requirements for the vegetable industry was sub-contracted to Dr Ben O'Neill. Dr O'Neill is a statistical consultant with qualifications in Actuarial Studies, Law, Economics and Bayesian Statistics (in which he holds a Doctorate) and so was well-qualified to undertake the review.

The study was completed during the course of the Bridging Project and the methodology, results and recommendations are detailed in the 123-page final report (Appendix 2) which contains 15 key recommendations. The report also includes a plan for continued access to data. The final report was presented to the Vegetable IAC at a recent face-to-face meeting held in Sydney. A number of the recommendations in the final report concerning external data sources have already been implemented as part of the Bridging Project whilst others will be implemented as part of the proposed three-year industry development project.

- 3.3 1800 Agronomist feasibility investigation and tender process

Many Australian vegetable growers, particularly those who operate small and medium sized businesses, do not have regular access to agronomists to provide advice about on-farm issues. AUSVEG was asked to consider the feasibility of a service for growers which would provide them with an on-call 'remote' agronomist who could be contacted by telephone in order to obtain general advice regarding on-farm issues. The concept could be trialled initially for six-months if it was deemed feasible to evaluate its effectiveness and uptake by growers. Based on enquiries with the agronomic sector and questions about legal and technical impediments, it was clear that there was merit in testing the concept further as there were indications that such impediments could be worked through.

A brief for the project was written and then approved by HAL and tenders were subsequently sought. One criteria was that the successful service provider would refer growers who wished to access vegetable R&D to the AUSVEG Knowledge Management website in cases where this was deemed an appropriate mechanism to find the relevant information the grower was seeking. It would be a requirement that the successful service provider must become familiar with the R&D that is contained within the database and its potential application on-farm. It was noted that the R&D database that is hosted on the AUSVEG website sits behind a secure login and contains a comprehensive catalogue of the HAL R&D related to vegetables that has been completed over the

past decade. It was stipulated that this was a valuable levy-funded resource managed by AUSVEG that the vegetable industry felt could be a used in a complementary way to assist growers and agronomists alike with their informational requirements, however, it was noted that it should not be referred to in isolation and some interpretation of the information and assistance from the service provider may be required in accessing this resource. Tenders that were received in response to the brief were reviewed by an independent panel convened by HAL (not including AUSVEG).

- 3.4 Consumers and Market Program tender process

AUSVEG and HAL coordinated a tender process which sought an innovative market research provider to bring new ideas and insights to the vegetable industry via regular reporting that would be appropriate for the vegetable grower target audience.

A detailed fully-costed three-year project proposal was required in response to the project brief. The proposal needed to outline the methods and strategies a consumer/market research provider would put forward to meet the industry's goal of an improved understanding and profitability of the vegetable industry.

An approved list of service providers with expertise in market research were approached by AUSVEG to tender for the project and respond to the brief. All the project proposals received were reviewed by a review panel and a referral has now been made to the Vegetable IAC for consideration.

- 3.5 Upgrades and review of the Knowledge Management System

Under AUSVEG's management the Knowledge Management System was reviewed to determine changes that could be made to improve access for the target audience of vegetable levy payers and agronomists. It was identified that a number of fundamental features were missing which AUSVEG had been informed were technically impossible using the Business Catalyst platform. AUSVEG conducted its own review of the programming code used to create the website on the Business Catalyst platform and was able to either modify this programming or use additional programming languages (e.g. JavaScript) to implement and amend the database/website to improve its functionality. The fundamental search and user interface features were added using this methodology.

The following improvements were made by AUSVEG to the Knowledge Management database as part of the Bridging Project:

- Simplification of the menu structure to enable easier access to information;
- Situating the R&D search engine more 'front and centre' with less click throughs now needed by the user to access information;
- The display of search results has been aesthetically improved and changed to a tabular format;
- Icon-based search results have been added to make it easier to distinguish different report types from one another by looking at a simple pictorial illustration;
- Implementing filtering/ordering of search results by HAL project number, report type, area of interest, year and title;
- The total number of search results and number of results currently on screen are now viewable by the user; and

- Customisation of the newly created 'Members Home' area has been implemented to display R&D content relevant to the user's profile / crop preferences, as well as the most recently uploaded R&D reports and industry publications.

- 3.6 Review and continuity of the Economics sub-program

A six-month continuity program was arranged for the Economics sub-program. The Economist role was outsourced to the IDEA consultancy. This structure would enable for data to continue to be provided over the duration of the Bridging Project whilst also providing an opportunity to evaluate the practicality and value of having the service outsourced in the future.

The key tasks during the six months surrounded a continuation of data supplied for the AUSVEG website, the production of two discussion papers and two magazine articles for Vegetables Australia magazine.

Training was also conducted by IDEA on two occasions at the AUSVEG office in relation to the Global Trade Atlas service used to access import/export data, and the ABARES and ABS websites used to access production data.

All articles and discussion papers produced during the six month Bridging Project were reviewed and edited by AUSVEG prior to publication. Feedback was provided to the consultant where necessary on any changes that were required. Ad-hoc data requests from the media and from AUSVEG, other industry bodies and growers, were also successfully fulfilled by the IDEA consultancy during the Bridging Project.

- 3.7 Supply Chain Briefings

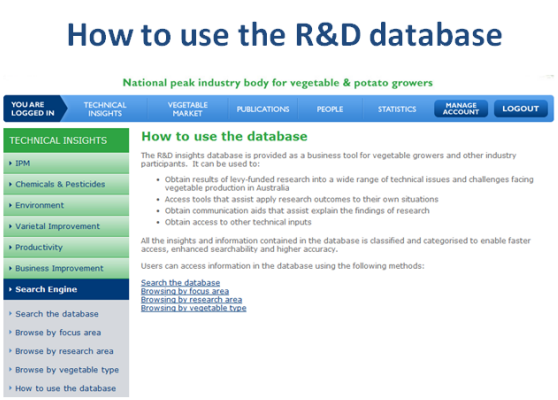
Further to the strategy identified by AUSVEG in the VIDP, AUSVEG has continued briefings with leaders in the supply chain as part of the Bridging Project in order to provide them with training on how to access and use the National R&D Database contained within the Knowledge Management System on the AUSVEG website.

AUSVEG was able to identify in the previous project that the majority of access to the R&D database online had been by intermediaries that growers deal with on a regular basis, such as agronomists, consultants and researchers. Accordingly, AUSVEG decided that it was important to stimulate greater involvement from these key groups and leverage from existing networks. Agronomists and other service providers were also in a position of trust and were seen by growers as credible information sources with which growers had more frequent interactions. By using the multiplier effect as it were, and leveraging from the inherent expertise of these parties, AUSVEG could play a significant role in ensuring that published R&D was being reviewed and relevant findings conveyed to levy payers. In this respect, the agronomists and service providers acted as a kind of filter, determining which R&D was relevant to the growers they were regularly interacting with.

Throughout the Bridging Project, AUSVEG conducted supply chain briefings with the following agribusiness organisations:

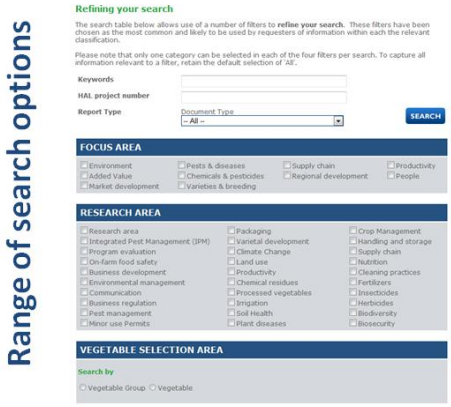
- Netafim
- E.E. Muir & Sons
- Farmoz

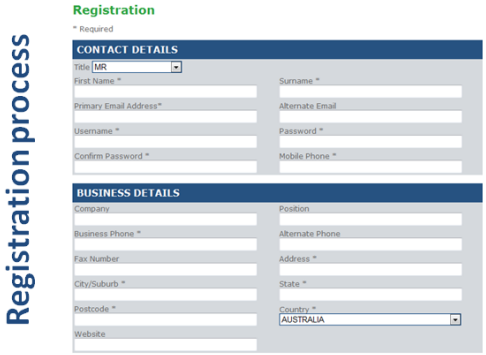
The following slides were used to guide attendees through the KM system, explain how it works and outline the range of resources and search options available to users of the system.



A slide explaining how to use the national R&D database

The process of searching was explained





The large range of search options was outlined, as was the registration process.

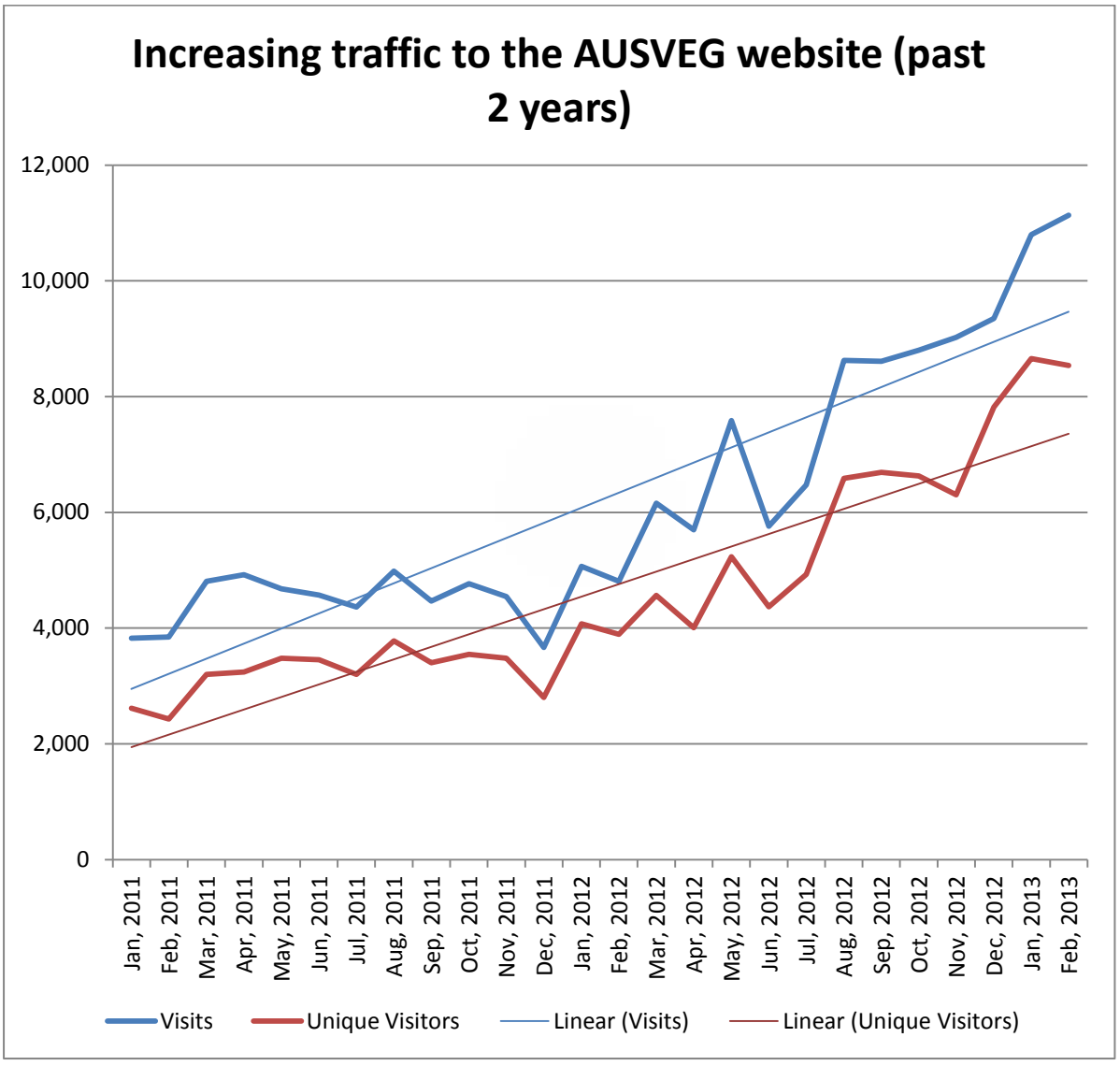
How to navigate search results was explained

It was explained that each report has been summarised

4.0 Evaluation

In evaluating the success of the Bridging Project an important barometer is website traffic to the AUSVEG website. Traffic has grown significantly since AUSVEG started promoting the website as part of the VIDP but has improved even more dramatically in the past 12 months, from an average of 4000-6000 visits in the first quarter of last year, to now over 10000 visits on a monthly basis during the past three months.

This provides a fair indication that AUSVEG's strategy of multi-channel communication with a range of different audiences, including levy payers and the supply chain that they deal with, is working.



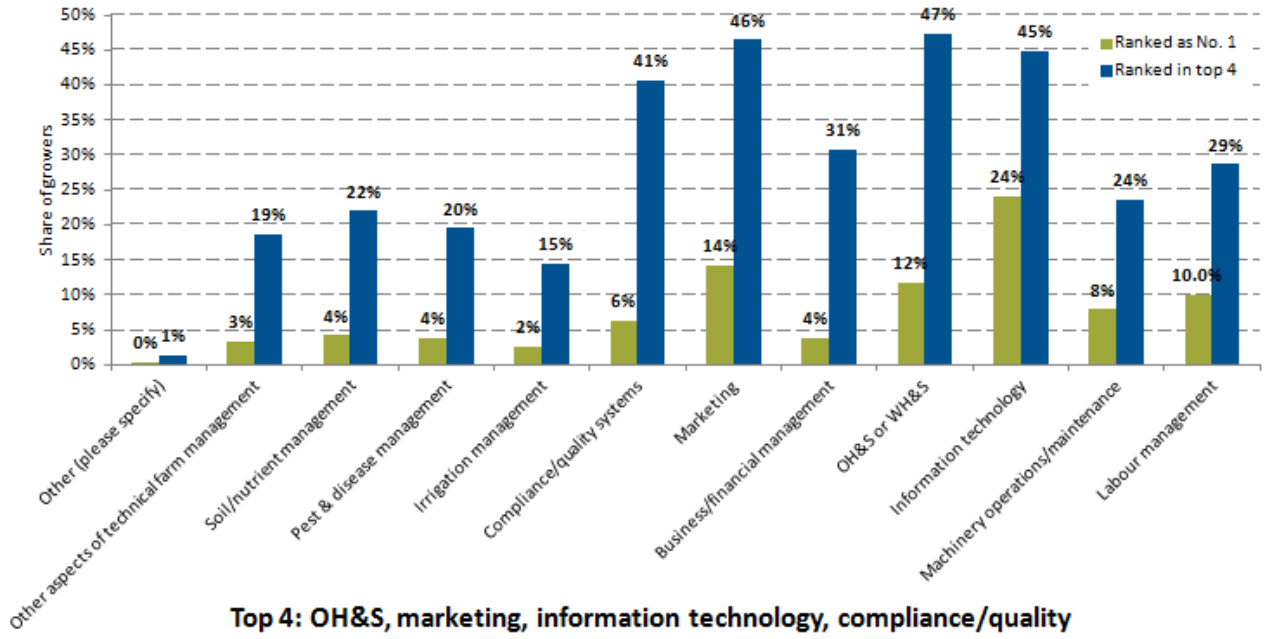
Membership to the AUSVEG website has also grown significantly, owing largely to promotional activities undertaken by AUSVEG. As at 13 March 2013 the AUSVEG website has 3046 members compared with 1503 in May 2010 and 2830 only a couple of months ago. Tellingly, the rate of membership growth to the website has been particularly strong since AUSVEG implemented the improvements to the Knowledge Management System mentioned in the Method section above; these changes have been implemented progressively over the past six months. Over 200 agronomists have also been directly registered for access to the AUSVEG website as a result of AUSVEG presentations about the Knowledge Management System. This does not include those from

the supply chain that have signed up of their own accord or as a result of other AUSVEG promotional activities.

As part of the National Skills and Training Scoping Study, Macquarie Franklin undertook a desktop review of training programs and tools, as well as a survey and qualitative interviews with growers regarding their training requirements. There were 151 responses received in relation to the survey component of the study (71 hardcopy, 80 electronic) and 90 grower interviews (41 phone, 49 personal) were conducted, geographically dispersed across the key growing regions around Australia.

While the survey/interview sample is not entirely representative of the industry, the results are supported by desktop study findings and are expected to reliably represent industry needs. An example is provided immediately below of the evaluation work that was completed as part of this study.

Ranking of Skills Weakness in the Vegetable Industry



Top 4: OH&S, marketing, information technology, compliance/quality

The final report by Macquarie Franklin (Appendix 1) comprehensively documents the findings of the scoping study. AUSVEG's recommendations regarding the study can be found in section 6 of this report.

Similarly, an evaluation of the findings from the Review of data requirements for the vegetable industry, concludes that the Bridging Project has been able to provide insight into this important area, in order to guide future activities.

The author surmises that "Access to data depends on continuing actions by outside agencies to obtain and compile this data. Nevertheless, there is a certain amount of core data available from the ABS under its Basic Information Set. If this source of data can be improved then this would lead to a stable and reliable long-term source of data that would be continually accessible to AUSVEG."

Figure P1 (below) illustrates the plan for continued access to data, which will essentially involve AUSVEG working with key data supply agencies to improve the data that is supplied. The full detail of the recommendations can be found in the final report by Dr O'Neill (Appendix 2).

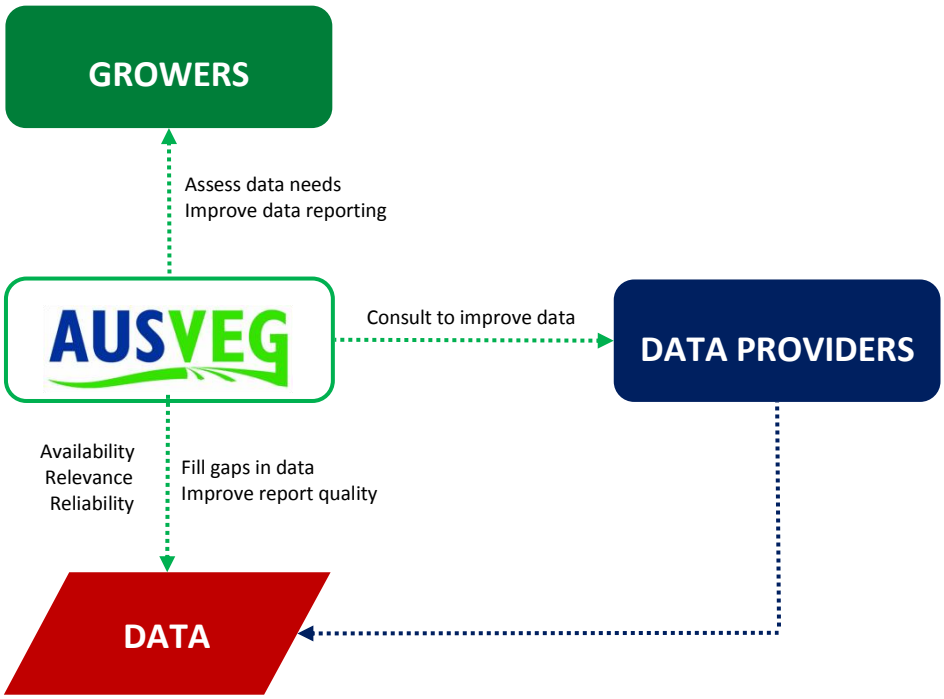


Figure P.1: Structure of plan for continued access to data

5.0 Implications

There is a range of implications from the Vegetable Industry Development- Bridging Project that will flow through to future industry development activities, as well as future investment through the Vegetable R&D Program. Recommendations from the Bridging Project are detailed in section 6 below.

The recommendations from the National Skills and Training Scoping Study (Appendix 1) and the Review of data requirements for the vegetable industry (Appendix 2) in particular, will provide vital direction for future investment in R&D that will be of benefit to the vegetable levy payer through more relevant skills and training programs and better quality and more reliable industry economic data. AUSVEG has recommended a range of training projects in section 6 below, as well as made recommendations in relation to the economist function within the vegetable industry.

Upgrades to the Knowledge Management System will result in a more streamlined R&D search engine, meaning easier access to the latest R&D for growers. The implication from these improvements is that there will be greater uptake and adoption of R&D outcomes due to more streamlined access to these resources, however, as recommended below, ongoing upgrades and maintenance will be required to keep this resource current.

Further improvements to the Knowledge Management System to enable remote access on iPads and smartphones and to notify growers about new R&D as it is uploaded are recommended. A more effective industry development program is recommended in section 6 of this report. The program will build upon previous investment in this area via a revamped and more cost-effective structure that offers improvements management, flexibility, industry alignment and tangible outputs.

6.0 Recommendations

Below is a summary of recommendations made as a result of the Bridging Project, categorised by subject area.

Economics, Data and Analysis

A six-month continuity program for the Economics function was outsourced to the IDEA consultancy that had previously been contracted as part of the VIDP. This ensured ongoing provision of data services for the industry during the Bridging Project, whilst allowing time to evaluate the feasibility of an in-house economic function.

During the Bridging Project it was determined that the economist function was a valuable function for the vegetable industry but that if it was managed within the PIB rather than outsourced, this would enable the outputs of the program to be more closely monitored to ensure it was delivering value for the industry. The program could also be undertaken on a more cost effective basis. This recommendation is consistent with the recommendation made by CIS in its review of the VIDP.

By having the Economist managed within AUSVEG this would also offer additional flexibility in order to respond to emerging issues in the vegetable sector and provide an enhanced analytical capacity to comment on issues such as consumer and business confidence. The Economist would be able to contribute commentary to assist with existing industry investment processes – for example, providing summaries and analysis to the Design Teams and IACs to inform and help make their decision-making processes easier by updating them on the 'state of the industry' from an economic perspective.

A review of data requirements for the vegetable industry was also conducted as part of the Bridging Project (see Appendix 2) by an independent statistical consultant, Dr Ben O'Neill, and it makes 15 recommendations on ways the industry can improve data quality and access for vegetable levy payers. Despite the project not requiring it, AUSVEG has already commenced actioning a number of these recommendations as part of the Bridging Project, including improving access to external data sources. A number of the recommended actions concerning improving data provision to levy payers will be able to implemented by the Industry Economist as part of the new three-year project, such as improving referencing and design of data sets.

Recommendations:-

- The vegetable industry economist function should be managed within AUSVEG to enable a higher output of work on a more cost-effective basis than in the past. This will enable closer monitoring and management of personnel resulting in greater industry interaction and engagement, including for instance, briefings for the Design Teams and IACs to better inform the new grower-driven investment program.
- Enhanced and more frequent economics coverage and industry analysis should be implemented for the vegetable industry, including commentary on the implications for vegetable growers of changes in consumer and business confidence, interest rates, and trends in production and financial performance data.
- The 15 recommendations of the independent Data review conducted by Dr Ben O'Neill should be reviewed and implemented by AUSVEG where possible, in conjunction with HAL.

Communications / Management

AUSVEG has a track record of providing valuable communications services to the vegetable industry. As part of the VIDP, AUSVEG achieved over 800 media mentions related to outputs of the Program. It is recommended that AUSVEG continue to utilise established industry publications such as Vegetables Australia, the flagship magazine in the vegetable industry, as well as establish new communication vehicles, such as an industry newsletter, that are specific to industry development. The recommendation that AUSVEG handle program management of the new three-year project is consistent with the recommendation made by CIS in 2011 and will enable AUSVEG to play a closer role in ensuring that the program delivers tangible and relevant outputs for levy payers.

Recommendations:-

- Coordinated program management should be undertaken by the Peak Industry Body, AUSVEG, with feedback to be obtained from growers as needed to improve the Program on an ongoing basis.
- Targeted communications will be utilised to promote increased use of the Knowledge Management System (KMS) which will encourage greater adoption of R&D on-farm.
- Briefings with leaders in the supply chain, such as agronomists and service providers, should continue in order to ensure increased use and adoption of the Knowledge Management System. AUSVEG briefings have so far directly resulted in over 200 agronomists being registered and briefed for access to the Knowledge Management System over the past two years. Rising website traffic indicates that this strategy has been successful in driving traffic to the website. Agronomists and service providers are a useful resource in communicating R&D to the growers they regularly deal with. It is also in their interests to assist in communicating relevant R&D to growers as it reinforces their role as a credible source of information.
- A range of communication channels should continue to be used in communicating information to levy payers to promote greater adoption of R&D, including media releases and articles, use of social media such as Twitter, SMS communications, and the production and distribution to growers of four hard-copy information sheets each year, plus a quarterly industry development e-newsletter.

Consumers & Markets

Across horticulture there is an increasing need to monitor and gauge the impact and return from industry activities and to rate these both across subject area and also against other agricultural areas. Specifically, the vegetable industry needs to better understand consumer attitudes to fresh produce, sales trends and market sizes for specific crops and the total industry, and have greater access to qualitative research on trends in consumer buying and behaviour as it relates to vegetables. Both ongoing updates on market trends, as well as a big picture overview will be necessary to identify gaps in the market. This will underpin development activities that may assist in expanding existing markets or making growers more profitable. There is a recognised need by the vegetable industry to better understand the consumer in order to leverage this information to influence purchasing decisions and refine product offerings. The industry is also interested in novel ideas for development

of vegetables as a product. Understanding the way different packaging and combinations of products affects consumer purchasing and the perception of vegetables as a snack, breakfast, lunch or dinner item are indicative examples.

During the Bridging Project, AUSVEG and HAL tendered for an innovative market research provider to bring new ideas and insights to the industry via regular reporting that is appropriate for the vegetable grower target audience. A detailed fully-costed three-year project proposal that outlined the methods and strategies a consumer/market research provider could put forward to meet the industry's needs was required. Following a comprehensive tender process, a preferred supplier was selected by the review panel and referred to the IAC for consideration.

Recommendations:-

- The IAC should consider the preferred project proposal from the Consumers and Markets tender process (coordinated by AUSVEG and HAL). This project will take place as an ongoing three-year project in order to provide ongoing tracking of insights into consumer behaviour, with the flexibility and funding needed to conduct custom market research on topical/emerging market-related issues for the industry.
- It is recommended that oversight for these activities be provided by the Consumer Alignment Design Team, along with feedback from AUSVEG and HAL.
- The proposed Consumers and Markets Program should have close linkages with the Coordinated Knowledge and Industry Development Program, and indeed the new AUSVEG program will be fundamental in ensuring output and adoption of the findings.
- AUSVEG should provide ongoing communications support for the proposed Consumer and Market project by communicating the findings of the program, once it is established, widely to the industry and by issuing media releases and producing regular information sheets on topics of interest.
- Outputs of the Consumers and Market should include:
    - Trends in consumer purchasing habits and sales of vegetables in Australia (segmented data as is possible).
    - Changes in the market size of vegetable industry and particular crops/crop groups.
    - News and innovations from around the world and how these may be implemented in an Australian context.
    - Vegetable category profiles, detailing shifts in consumer behaviour and sales of specific vegetable categories (these might be rotated on a monthly basis).
    - Vegetable pricing information and trends.

Skills and Training Scoping Study

A tender process was conducted in cooperation with HAL and drawing from a list of approved companies one provider was shortlisted and contracted to investigate skills and training within the vegetable industry.

The National Skills and Training Scoping Study was conducted by Tasmanian-based agricultural consultants Macquarie Franklin as part of the Bridging Project, with oversight provided by AUSVEG and regular engagement with HAL.

The aim of the study was to determine the areas of training that are needed to advance the vegetable industry and 'up skill' the existing workforce. A result of determining the areas of greatest need was to be future investment in training and skills resources in these areas through the Vegetable R&D program.

Through a desktop study, survey and qualitative interviews, the study was completed and has determined the highest priorities for the industry in respect of training to address deficiencies in the skill base. An emphasis was placed on those areas that may be improved in order to have the greatest possible impact. The recommendations of the study can be found from Page 49 onwards in Appendix 1.

Recommendations:-

- The outcomes of the training study require specialist expertise to implement and so AUSVEG recommends they are implemented following consideration by the Vegetable Industry Design Teams. Projects should be devised as distinct R&D projects addressing the specific needs highlighted in the scoping study rather than as part of the broad three-year project.
- The Vegetable Industry Design Teams should review the 8 areas recommended in Macquarie Franklin's Skills and Training Scoping Study Final Report (Appendix 1) for potential R&D projects at their May 2013 meeting.
- AUSVEG recommends that the following areas should be considered by the Vegetable Industry Design Teams at their May 2013 meeting as distinct or consolidated R&D training projects, under the R&D Drive Train structure outlined in the Vegetable Industry Strategic Investment Plan (SIP):
    - Negotiation training for growers in dealing with suppliers and others they do business with (see Page 42 in Appendix 1).
    - An OH&S Manual for vegetable growers, covering all aspects of OH&S specific to the vegetable industry (see Page 50 in Appendix 1).
    - Information Technology training for growers in each State (with two modules, potentially one on Accounting and one on General Internet/Computer skills) (see Page 52 in Appendix 1).
    - Business management training for managers and middle managers (see Page 49 in Appendix 1).
    - A leadership training course (note: Growing Leaders has recently been endorsed as the vegetable industry's preferred leadership training program) (see page 49 in Appendix 1).
    - Marketing training for growers, so that growers can better market their products to consumers and increase their understanding of marketing practices in relation to taking products to market most effectively (see Page 42 in Appendix 2).

Knowledge Management

Under the management of AUSVEG, a number of significant improvements to the Knowledge Management System (KMS) / National R&D Database have been made possible during the Bridging Project. Many of these fundamental improvements were previously indicated as not being technically possible when requests were made by AUSVEG to the third party service provider that managed the Knowledge Management System previously as part of the VIDP. Under AUSVEG's

management the following improvements have been made to the Knowledge Management database so far:

- Simplification of the menu structure to enable easier access to information;
- Situating the R&D search engine more 'front and centre' with less click throughs now needed by the user to access information;
- The display of search results has been aesthetically improved and changed to a tabular format;
- Icon-based search results have been added to make it easier to distinguish different report types from one another by looking at a simple pictorial illustration;
- Implementing filtering/ordering of search results by HAL project number, report type, area of interest, year and title;
- The total number of search results and number of results currently on screen are now viewable by the user; and
- Customisation of the newly created 'Members Home' area has been implemented to display R&D content relevant to the user's profile / crop preferences, as well as the most recently uploaded R&D reports and industry publications.

Recommendations:-

- AUSVEG should investigate the technical feasibility of automatic R&D notifications for growers when new R&D content that matches a growers' profile is uploaded to the searchable database. This will assist in increasing usage of the system by growers at any time/location.
- AUSVEG should investigate the creation of a mobile/tablet compatible version of the National R&D Database to increase accessibility for growers and agronomists in the field. This will reinforce the National R&D Database as a central resource via which R&D can be accessed by growers and the broader industry.
- 'Flip page' and search functionality should be implemented for key industry R&D publications such as Vegetables Australia, to make them more accessible as part of the Knowledge Management System.
- A new name for the Knowledge Management System should be devised as part of the proposed three-year project and this should be used to more effectively market the resource to growers in an modern and appealing way in the future.
- Further refinements should be made to the search menu, speed and functionality of the National R&D Database as needed to continue to streamline accessibility for growers and other users.
- The Knowledge Management / National R&D Database should continue to be maintained on an ongoing basis by AUSVEG, including the updating of new R&D reports once they are approved by HAL.
- As part of the new three-year project AUSVEG should investigate the technical feasibility of a major overhaul of the current database upload system implemented by the previous service provider, so that there are less steps involved in adding R&D reports to the database and the system is more streamlined via a simple web form.

1800 Agronomist Service

Following a tender process where a range of leading agronomy providers were invited to tender, the highest ranked provider was selected by an independent project reference group approved by HAL

and not including AUSVEG. The project reference group recommended that a private agronomy company be awarded a six month pilot to trial and test the concept of a 1800 Agronomist in real conditions. It is recommended that this trial be embedded within the three-year project proposal for the new industry development program.

Recommendations:-

- The 1800 Agronomist service should be trialled over six months as part of the new three-year industry development project proposed by AUSVEG. This should occur within the first 12 months of the three-year project and the findings should be reported back to HAL and the IAC for review in order to determine whether the concept should be pursued.
- A comprehensive log book of activities and calls should be recorded and provided to AUSVEG and HAL as part of the final report.
- The agronomic service provider should provide regular feedback to AUSVEG and HAL on the success of the service from their perspective, including impediments and successes.

Conclusion

In summary, the three-year industry develop project proposed by AUSVEG incorporates many of the recommendations outlined above, while others will be progressed by the industry development program through the Design Teams and associated processes, as they are more suited to discrete R&D investment projects rather than incorporation within a broad-based program i.e. specific skills and training projects.

The Bridging Project has made significant recommendations that will shape the future of industry development in the vegetable industry and has enabled AUSVEG, together with HAL, to propose the most appropriate structure for industry development to occur successfully within the vegetable industry in the future.

7.0 Appendices

Appendix 1 - Review of skills and training in the vegetable industry (final report by Macquarie Franklin).

Appendix 2 - Review of the domestic and international data requirements for the Australian vegetable industry (final report by Dr Ben O'Neill).

Appendix 3 – IDEA Vegetables Australia article on 'How serious is the Chinese threat to Australian vegetable growers?' (published November 2012)

Appendix 4 – National Skills and Training Desktop Review (report by Macquarie Franklin).

Appendix 1

Review of skills and training in the vegetable industry (final report by Macquarie Franklin).

Review of skills and training in the vegetable industry

Final report

14 December 2012

Horticulture Australia

Consultants for business, agriculture and environment

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

Macquarie Franklin was formed in April 2011 by the merger of two Tasmanian based consulting firms - Agricultural Resource Management (ARM) and Davey & Maynard.

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30/11/12	Final	John Guenther	L Sherriff	email
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Executive summary

This report presents the outcomes of a vegetable industry skills and training scoping study that was undertaken by Macquarie Franklin and Cat Conatus on behalf of AUSVEG. The purpose of the vegetable industry skills and training scoping study is to enable HAL and AUSVEG to better target grower levy funds to actions which will improve the uptake of training and skills development in the vegetable industry. The scoping study involved two distinct components:

1. A desktop review of training programs and tools available to the Australian vegetable industry, and

2. A survey of vegetable growers around Australia that enabled vegetable growers around the country to indicate their needs with respect to skills and training.

The results obtained from the survey and interviews were generally in line with previous studies and with opinions expressed by state industry body representatives. Growers rated their key skill weaknesses as:

- OH&S
- Marketing
- Information technology
- Compliance/quality systems

The key skills they were interested in improving were ranked as:

- Information technology
- Business/financial management
- Marketing
- Soil/nutrient management

Improving profitability and production efficiency are the key reasons why growers undertake training and why they offer training to staff.

Convenience and time constraints are the key barriers to growers participating in training.

Growers prefer to learn mainly by attending informal training sessions, followed by formal training courses and receiving independent advice/support one on one.

Agricultural advisors/consultants were the key training provider used followed by private RTOs and agriculture departments/state industry bodies.

The key ways in which Research and Development is extended to growers are articles in newspapers/magazines, external advisors, and at workshops/field days.

Very few apprentices or trainees are employed in the industry, and employee characters and experience (good work ethic, willingness to learn and previous practical on-farm experience) were ranked as being more important than qualifications.

Access to a reliable unskilled labour pool (many of them who speak a language other than English) was highlighted as being of critical importance.

Course offerings of Vocational Education Training (VET) do not appear to be meeting the needs of the vegetable industry.

The information collected in this study has been used to identify eight key training needs for the vegetable industry. They are listed in order of their likely impact on the vegetable sector, measured as reach across the industry and demand within the industry:

1. **Leadership, management and communication skills**

   Leadership, management and communication skills were highlighted in the interviews in relation to management and supervision of workers by both growers and middle management/supervisors, in medium to large sized businesses. Vegetable industry specific training is required that targets middle management/supervisors.

2. **Occupational Health and Safety (OH&S)**

   OH&S was raised prominently by growers as an issue that should be addressed through the use of the National Vegetable Levy, especially by growers in small and medium sized businesses. Four key areas of need are: development of a manual on OH&S specific for the vegetable industry; resources for policy/procedure development; OH&S technical support; training for workers in their OH&S obligations and safe operating procedures (including the development of language other than English resources).

3. **Business and financial management**

   Good business management and financial skills are critical for growers to remain competitive in the current economic climate, especially younger growers. This issue has been highlighted in previous studies of skills and training in the vegetable industry.

4. **Information Technology (IT)**

   Skills gap in IT has been widely identified previously and was strongly highlighted in the survey and interviews. This gap predominantly impacts older growers, and impacts on their access to information and business efficiency. Training must be hands on, practical and aligned to the needs of vegetable growers.

5. **Marketing and promotion**

   There are two main issues related to marketing: marketing by individual farm businesses and industry promotion more broadly. Business marketing includes supply chain management, business development, promotion, keeping pace with national and international trends, as well as consumer expectations, and is mainly required by medium-sized businesses. Industry promotion was highlighted during interviews as a significant issue in relation to the use of levy funds. Good effective industry promotion is critical for two main reasons; to encourage

support for the industry from consumers (related to industry profitability) and to encourage young people to consider a career in the vegetable industry.

6. **Regionally targeted training**

   A clear message from the interviews was the need for training to be site specific and relevant. Growers are looking for training that can be applied directly to their context. By state there were differences in skill improvement priorities. There is demand for mobile trainers to deliver training particularly for employees, on-farm.

7. **Investment in digital technologies**

   Digital technologies are quickly being adopted by growers for a variety of purposes, and the trend towards uptake of digital technologies and associated resources will increase in the next decade. There is a role for AUSVEG and state vegetable industry bodies to continue to promote the use of web-based resources and tools and to ensure communication and technology within the industry keeps pace with technological advances.

8. **Productivity**

   The main reason growers undertake training themselves and provide training to staff is to increase profitability and efficiency of the business. It is important for course providers to clearly demonstrate the link between courses and seminars about what may be perceived as relatively unproductive topics (e.g. QA and compliance, WHS/OHS, R&D findings, business and financial management) and farm productivity and production efficiency.

In addition to the key training needs, a number of implications and considerations have also been identified. Some of them are relevant to a number of training needs, while others have particular implications for specific sectors of the vegetable industry. The purpose of highlighting them is to suggest methods of delivery to address the training needs:

1. **Targeted training**

   Targeted (not generic) training is important, especially for employee training. The most ideal form of targeted training is on-site by a mobile trainer. Growers themselves also prefer smaller more industry/sector specific training (whether formal or informal).

2. **Informal learning opportunities**

   Demand for informal learning such as field days, farm tours, etc is very high, especially in relation to farm management. Informal training opportunities should continue to be supported.

3. **LOTE workers**

   There is a heavy reliance throughout the industry on workers who speak a language other than English as their first language. There are challenges, mainly related to communication

and OH&S, in employing these workers. Growers require assistance to meet these challenges.

4. **Grower networks and information sharing**

   While many growers are supportive of the idea of discussion or benchmarking groups, the competitive nature of the industry prevents this occurring. A lack of cooperation between growers may be restricting industry development - this is potentially a major challenge for the industry.

5. **External advisors/consultants**

   External advisors and consultants are highly regarded by growers as training providers and for finding out about tools and research outcomes. Engaging with this existing network will enable more effective communication with and up skilling of growers. Provision of levy funding for extension staff is another option that might be considered.

6. **Tools and extension materials**

   Tools, calculators and other extension materials have limited value as standalone learning resources, particularly when the major way they are disseminated is via the web. The main value of tools appears to be as a component of training courses. Storage of information on the web, so it can be easily found by growers is an important consideration. Farmer case studies are a useful extension tool.

7. **Subsidies and grants**

   Subsidies and grants would be an incentive to growers for the training of employees.

8. **Developing and nurturing the skill set of younger growers**

   Encouraging and supporting the growing skill set of young growers will enable the industry to evolve in concert with the changing world.

9. **Formal VET training sector**

   While demand for apprenticeships and traineeships is limited, demand for specific vocational skills that support business productivity and ensure compliance with legislative and regulatory requirements is high. The VET sector is an important source of training for these specific vocational skills. However, there are criticisms with the VET sector which will need to be addressed for growers to engage in training with the VET sector.

1 Introduction

1.1 Background

This report presents the outcomes of a vegetable industry skills and training scoping study that was undertaken by Macquarie Franklin and Cat Conatus on behalf of AUSVEG. It is an output of the Horticulture Australia (HAL) R&D project VG11038 and has been funded through the National Vegetable Levy with matched funds from the Australian Government.

The purpose of the vegetable industry skills and training scoping study is to enable HAL and AUSVEG to better target grower levy funds to actions which will improve the uptake of training and skills development in the vegetable sector. The scoping study involved two distinct components:

1. A desktop review of training programs and tools available to the Australian vegetable industry, and
2. A survey of vegetable growers around Australia.

The aim of the desktop study was to review training programs and tools available to the Australian vegetable industry with the view to obtaining sufficient information to develop and implement the vegetable industry survey. The desktop study was a comprehensive review of existing literature on skills/training within the vegetable industry, and of training tools and programs available for the vegetable industry.

The aim of the second stage of the study was to obtain direct feedback from vegetable growers around the country on their needs with respect to skills and training (for both themselves and their employees). This feedback was gathered via a survey which aimed to identify current strengths and weaknesses with regards to skills development in the vegetable industry, how growers improve their skills, grower learning preferences, areas where growers feel there are skills and training gaps and any other issues. There were three methods used to collect grower feedback: hardcopy or electronic survey; phone interview; personal interview.

The lack of uptake of skills and training in the agricultural sector has been highlighted in a number of recent studies. The risk that this poses to the long term viability of the industry (including vegetable production was highlighted by AgForce in 2011 – '*the disconnect between increasingly complex agricultural systems managed by producers and the uptake of formal education is a significant risk that may, in the longer term, impact innovation and production system change, including adoption of new crop cultivars and livestock breeds which leads to higher productivity*'[1].

Recognising the low rate of skills and training uptake in the agricultural sector more broadly, this study aims to assist AUSVEG to identify barriers to training and skills development within the vegetable industry so progress can be made toward improving training outcomes for members.

[1] Standing Committee on Education, Employment and Workplace Relations: Inquiry into meeting the education skills requirements for the agriculture sector in Australia, AgForce 8 November, 2011

2 Methodology

2.1 Desktop review

The desktop review consisted of internet searches and telephone discussions with representatives from vegetable grower organisations in each state.

2.1.1 Discussions with grower organisations

The organisations that were contacted as part of this study included:

- Growcom – Queensland
- VGA Victoria
- Grow SA
- TFGA – Tasmania
- Bowen Gumlu Growers Association
- Vegetables WA
- NSWFA
- Bundaberg Fruit and Vegetable Growers

Where additional contacts were provided during discussions these were also followed up (e.g. NSW DPI, HAL).

Grower organisation discussions were conducted to give a better understanding of the training 'landscape' in each state – what types of programs are being delivered by whom, what kind of training is in demand from growers, what the issues are around training, what organisations deliver what kinds of training, working with growers who don't have English as a first language (LOTE), use of computers/technology amongst growers, etc.

Some states have recently prepared reports on skills and training in agriculture (e.g. Tas and Qld) – where available these were reviewed as part of this study (refer to section 2.2.4 for more information).

2.1.2 Internet searches

The Good Universities Guide (www.gooduniguide.com.au) was used to search for information on Universities and TAFEs, and information about other training programs was found through other searches (e.g. industry group websites, agriculture/primary industry department websites, etc). The AUSVEG and HAL websites were also searched for information relevant at a national level.

Tools and information which could be used by growers to increase their skills or knowledge were found by undertaking three types of internet searches:

- Google key word search.

- Search of grower websites and departmental (agriculture or primary industries) websites in each state.
- Search of AUSVEG website.

The rationale for this method of searching was that it was considered to be the main approach growers would adopt when searching for similar information.

2.2 Survey and interviews

2.2.1 Survey development and distribution

The survey questions were designed by Macquarie Franklin in conjunction with Cat Conatus with input from AUSVEG, based on the outcomes from the desktop study. The questions were approved by AUSVEG and HAL, and were trialled by three Tasmanian vegetable growers from three different operations to ensure that wording, survey structure, etc was farmer-friendly. A copy of the survey is presented in Appendix 2. Copy of grower survey. The chance to win an iPad was offered as an incentive to encourage growers to complete the survey.

The survey was distributed in three ways:

- On-line survey.
- iPhone survey.
- Hardcopy survey.

The hardcopy survey was distributed with the Vegetables Australia magazine, to 6100 members on the AUSVEG database. It is acknowledged that not all these members are vegetable growers, and therefore not all of these members were eligible to complete the survey (the survey was specifically aimed at growers, rather than other industry participants).

The online and mobile device versions of the survey were created using an online survey provider, Qualtrics. These electronic survey options were promoted by AUSVEG using their member email database and via an article in the Vegetables Australia magazine. Contacts within each of the state vegetable industry bodies were also notified about the survey by email and encouraged to promote it amongst their members. The survey and interviews were conducted with managers/business owners (employee perspective on skills and training was beyond the scope of this study).

A summary of grower responses to the different survey methods is presented in Table 1. While the on-line survey received more responses overall, many of these were incomplete.

Table 1: Summary of responses by survey method

Survey method	Total number responses
On-line	79
iPhone	1
Hardcopy	71
Phone interview	41
Personal interview	49
TOTAL	241

2.2.2 Grower interviews

An internal procedural document was drawn up by the project manager, to ensure that a standardised process was used for contacting growers and conducting the interviews. While interviewers were encouraged to let interviewees speak openly and cover whatever issues they wished to raise, there were specific areas that were covered in every interview, to ensure some consistency. In addition to the survey questionnaire, these included managing LOTE staff, experience with apprenticeships, role of travel in learning/sharing information, etc.

Growers on contact lists provided by AUSVEG were all contacted by phone and asked if they were interested in participating in the study and providing their perspective on skills and training in the vegetable industry. A summary of the growers response to a request to participate is presented in Table 2. There was a large variation in the response of growers to the survey depending on region. The average across the country was that 54% of growers initially contacted participated in an interview.

A total of 90 growers across the country were interviewed (41 by phone and 49 in person). The time taken for personal interviews was generally between 1-2 hours, and the time for phone interviews between 30 minutes to 1 hour.

Table 2: Detailed summary of grower response to requests for interview

Area	contacted	unable to contact*	unavailable /uninterested#	Complete alone^	phone interviews	personal interviews	% unable to contact*	% unavailable /uninterested#	% interviewed
Tasmania	14	1	3	0	1	9	7	21	71
NSW	20	4	11	0	5	0	20	55	25
South Australia	16	0	3	1	1	11	0	21	86
Carnarvon	8	0	4	0	4	0	0	50	50
Kalbar/Stanthorpe	12	0	1	1	7	3	0	8	83
Gatton	17	5	2	0	0	10	29	12	59
Bowen/Bundaberg	18	2	4	2	10	0	11	22	56
Waneroo/Myalup	19	1	7	1	10	0	5	37	53
Gippsland/Mornington Peninsula	20	4	3	2	3	8	20	15	55
Werribee/Bacchus Marsh	24	5	7	4	0	8	21	29	33
TOTAL	168	22	45	11	41	49	13	27	54

* includes growers where contact details provided were not correct and alternative contacts were not available, as well as growers that were left several phone messages (at least 3) and an email was sent to advise them of the project - invariably these phone messages and emails were not returned.

includes growers who were overseas at the time of visits, those where a conflict of interest arose, growers who are no longer vegetable producers. In some areas a large proportion in this category are those where multiple interviews were scheduled and rescheduled and then not able to be conducted for various reasons. Other growers contacted were simply too busy or not interested.

^ growers in this category were unable to participate in interviews for various reasons but were able to complete the survey in their own time.

2.2.3 Data analysis

Data collected from the surveys was collated into a single Microsoft Excel™ spreadsheet file. The first level of analysis involved the production of simple cross-tabulations with descriptive and summary statistics for each variable. The second level of analysis compared each of the demographic characteristics of the sample (age, location, LOTE, qualification, business size, gender and years of industry experience) with each question (except those that asked for qualitative descriptive responses). In each case, the variables were compared for significant differences within the group using chi-squared tests. From these statistical tests, whether the demographic characteristics affected respondent choices was able to be determined. Demographic differences highlighted in the results section had chi-squared tests of $p<0.05$ or $p<0.1$.

Data recorded from the interviews and qualitative data collected in the survey, were collated and analysed in an NVivo™ (qualitative analysis software) database. The software is used to identify and 'code' themes that emerge from the descriptive data. This data is then analysed so that the relative strength of themes can be assessed and cross-tabulated with demographic variables. In this way the relationships between one variable was analysed in much the same manner as the quantitative data collected in the survey.

To identify the eight training priorities discussed in the recommendations section, both sets of data were used to draw conclusions. Within the quantitative data set, the important questions for this assessment included those related to intention to improve skills, skill weaknesses, reasons for training, discouragers, preferred learning method, training providers, R&D extension as well as factors that encourage staff training. In the qualitative data, questions about attitude to training and best use of the National Vegetable Levy were used inductively to determine training priorities of growers. However, the nature of qualitative interviews means that as respondents answer questions ideas emerge that can fit into any of the coded categories. The analysis software allows for this coding and analysis to be carried out seamlessly. Further, a synthesis of all the data was used in the discussion about the implications and considerations that emerged from the key training needs that were identified.

The likely impact of key recommendations in this study was assessed using a combination of the *reach* of the initiative across the industry and the *demand*, or likely uptake, of the initiative. That is, initiatives that are likely to affect a larger number of employees and have a higher propensity to be taken up are more likely to have higher industry impact. In addition industry training needs that were identified in the desktop study were also rated as being likely to have a higher impact. 'Impact' is a term that can be considered from a number of perspectives, which could include industry sustainability, productivity, uptake, reach and competitiveness. It is beyond the scope of this study to take all these measures into account as data required to make some assessments (for example financial information) was not collected.

3 Results

3.1 Comparison of survey demographic with overall vegetable industry demographic

In total 241 growers responded to the survey. This compares with an estimated 6,594 vegetable growing businesses in Australia[2], indicating a survey response rate of 2.1%. The responses to each of the questions asked in the survey to determine demographics are presented as tables and charts in Appendix 1. Results from grower survey.

A state based breakdown of survey responses and the share of vegetable growing businesses operating in each state is detailed in Figure 1. The survey/interview sample has under-represented growers from NSW and over-represented growers from Tasmania and Queensland.

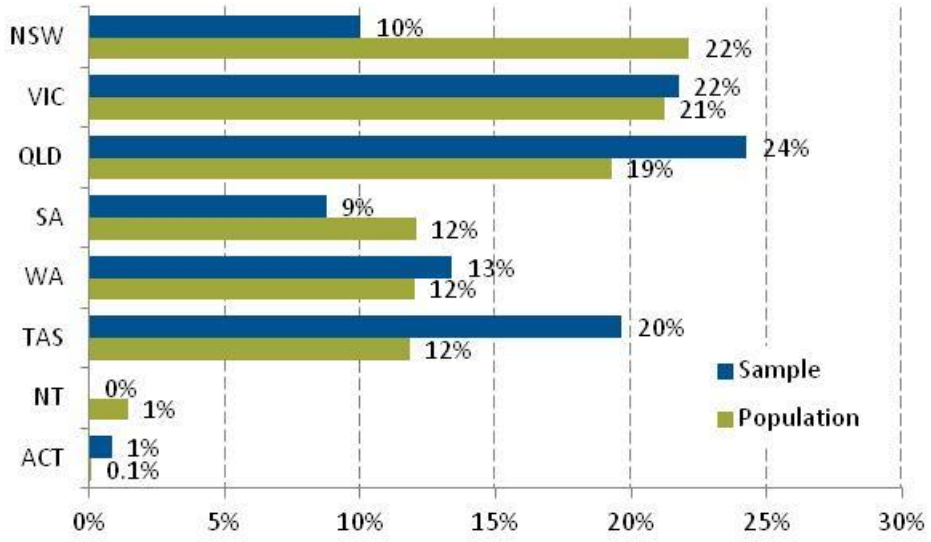


Figure 1: State-based representation of the survey sample compared to industry figures

(Survey sample size = 241; Population data source ABS 2006 Census of Population & Housing – Labour Force Status)

Figure 2 describes the age structure of survey/interview respondents compared to the industry, which is comparable except for the survey/interview sample under representing up to 25 year olds.

Figure 3 describes the educational attainment of survey/interview respondents compared to the industry. This data indicates that the growers in the sample have attained a higher level of education that the general population

Managers have been used as the industry standard as most of the respondents to the survey were managers / business owners.

[2] ABS 8165.0 Counts of Australian Businesses 2010-11

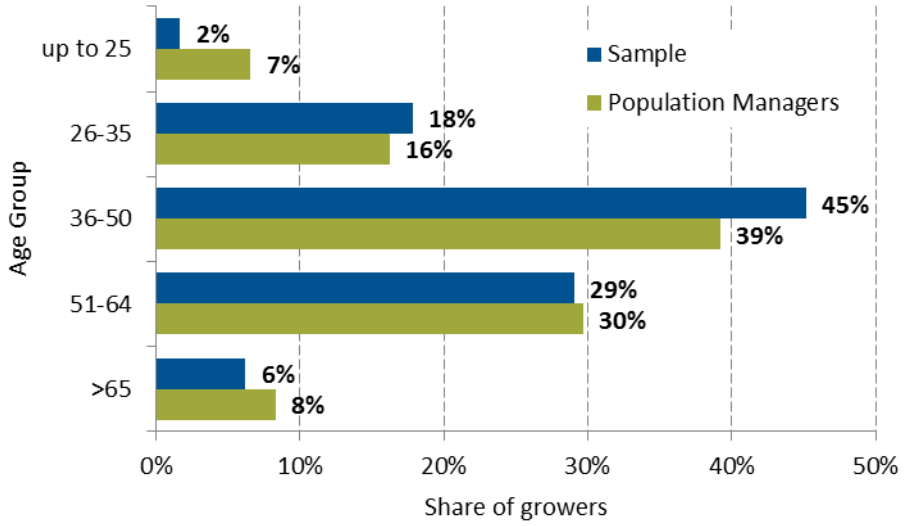


Figure 2: Age structure of the survey sample compared to vegetable industry managers

(Survey sample size = 241; Population data source ABS 2006 Census of Population & Housing – Labour Force Status)

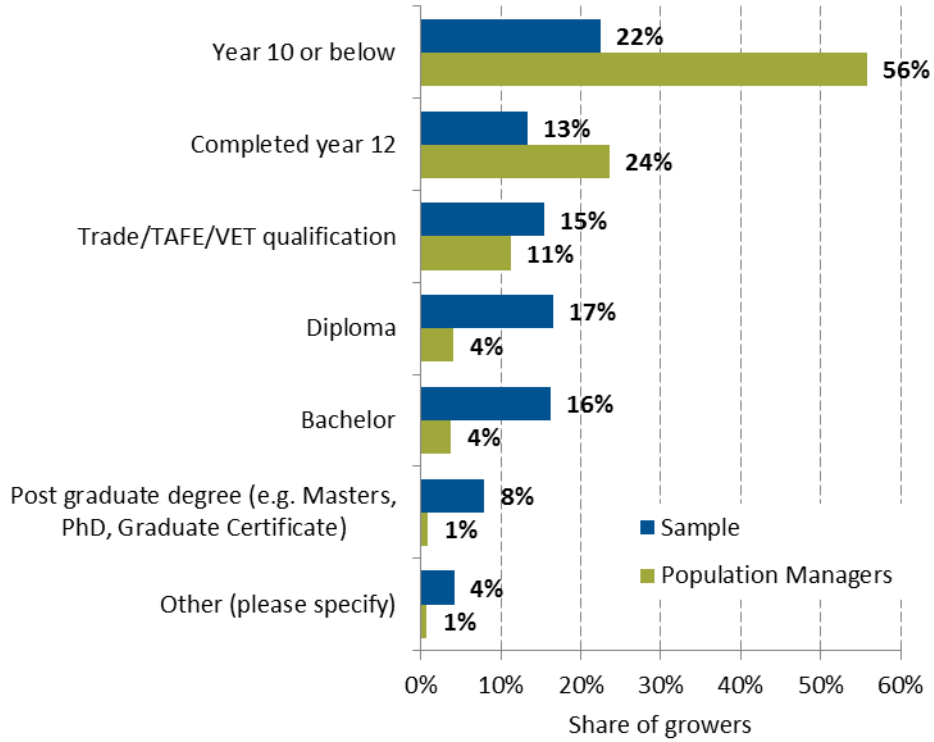


Figure 3: Highest level of education of the survey sample compared to vegetable industry managers

(Survey sample size = 241; Population data source ABS 2006 Census of Population & Housing – Labour Force Status)

Although the response rate to the survey was low, and the demographic of the sample somewhat different to that which would be typical of the industry, the results obtained from the survey and

interviews do reflect those of previous studies and anecdotal evidence provided by industry bodies. Therefore, the recommendations based on the data collected are expected to reliably represent industry needs.

3.1.1 Respondent demographics

41 growers who identified having a language other than English as their first language responded to the survey (Figure 27, Appendix 1). The most common languages spoken were Italian (10) and Vietnamese (5), with 1 or 2 respondents from each of the other language groups (listed in Table 6, Appendix 1).

There was a large influence of age on very high and low educational qualifications (Table 3). Older growers (over 51 years) were more likely to identify year 10 and below as their highest qualification, whereas younger growers (under 35 years) were more likely to identify a bachelor degree as their highest qualification.

Table 3: Grower age vs level of qualifications

	Up to 25	26-35	36-50	51-64	>65
Year 10 or below	0	4	24	21	5
Completed year 12	1	7	13	9	2
Trade / TAFE / VET	2	7	18	7	3
Diploma	0	7	17	14	2
Bachelor	1	13	20	3	2
Post graduate degree	0	2	9	8	0
Other (please specify)	0	2	4	4	0
Education level not specified	0	1	4	4	1
	4	**43**	**109**	**70**	**15**

(Sample size = 241; 10 growers did not state their level of education)

3.2 Survey results

This section of the report details the results from the grower surveys and interviews. The implications of these in the context of findings from the desktop study are covered in the Discussion (Section 4).

3.2.1 Skills

The skill strengths most commonly ranked by growers as being in their top four are (Figure 4):

1. Irrigation management
2. Pest and disease management
3. Business/financial management
4. Machinery operations/maintenance

The ranking of skill strengths was influenced by demographics - those in the under 35 age group were more likely to rank information technology as their greatest skill, than growers in other age brackets. Business type also influenced the skill strength ranking - growers who process only are more likely to select OH&S as a skill strength and growers from larger businesses are more likely than other businesses to identify their strongest skills as marketing and compliance/quality.

Educational background also influenced how growers ranked their skills:

- Growers with year 10 or below qualifications were more likely to identify areas of on-farm management as their greatest skills (e.g. machinery operations and maintenance, irrigation management, pest and disease management);
- Those who had higher levels of qualifications (e.g. diploma or bachelor) were more likely to identify information technology as their greatest skill.
- Growers with bachelors were also more likely to identify business management as their greatest skill.

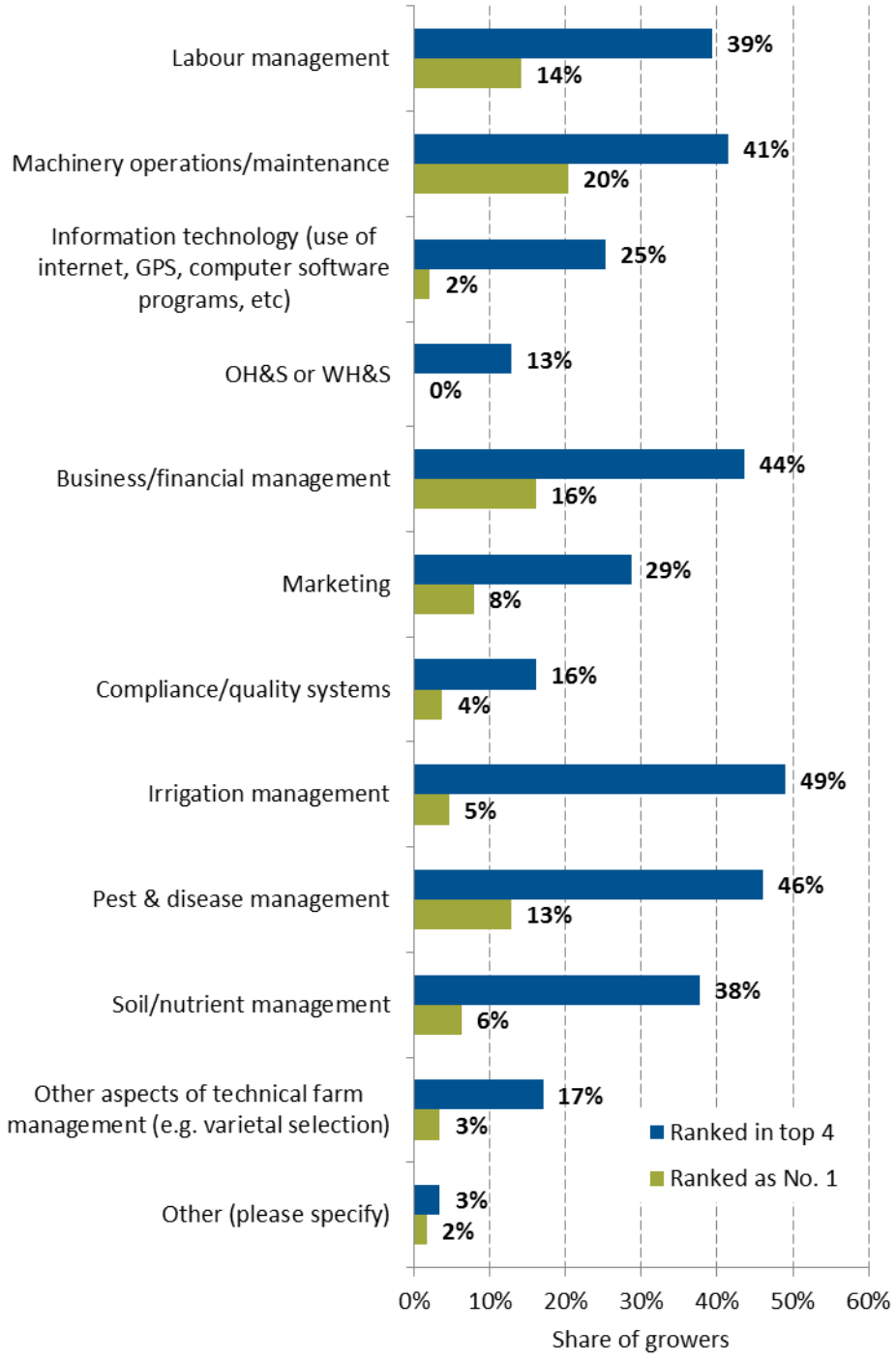


Figure 4: Grower ranking of skill strengths

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 4 shares do not add to 400% as 17 growers did not provide a number 1 ranking, 22 growers did not provide a number 2 ranking, 23 growers did not provide a number 3 ranking and 33 growers did not provide a number 4 ranking.)

The skill weaknesses most commonly identified by growers as being in their top four are (Figure 5):

1. OH&S (WH&S)
2. Marketing
3. Information technology
4. Compliance/quality systems

Skill weakness is influenced by grower age and educational qualifications, with older growers (>51 years) and growers with year 10 or below qualifications more likely than other age/educational groups to nominate information technology as their greatest weakness. Ranking of skill weakness also varied depending on the size of the business – small (<5 permanent employees) and medium sized (6-20 permanent employees) growers were more likely to identify their weakest skills as business and financial management than larger businesses.

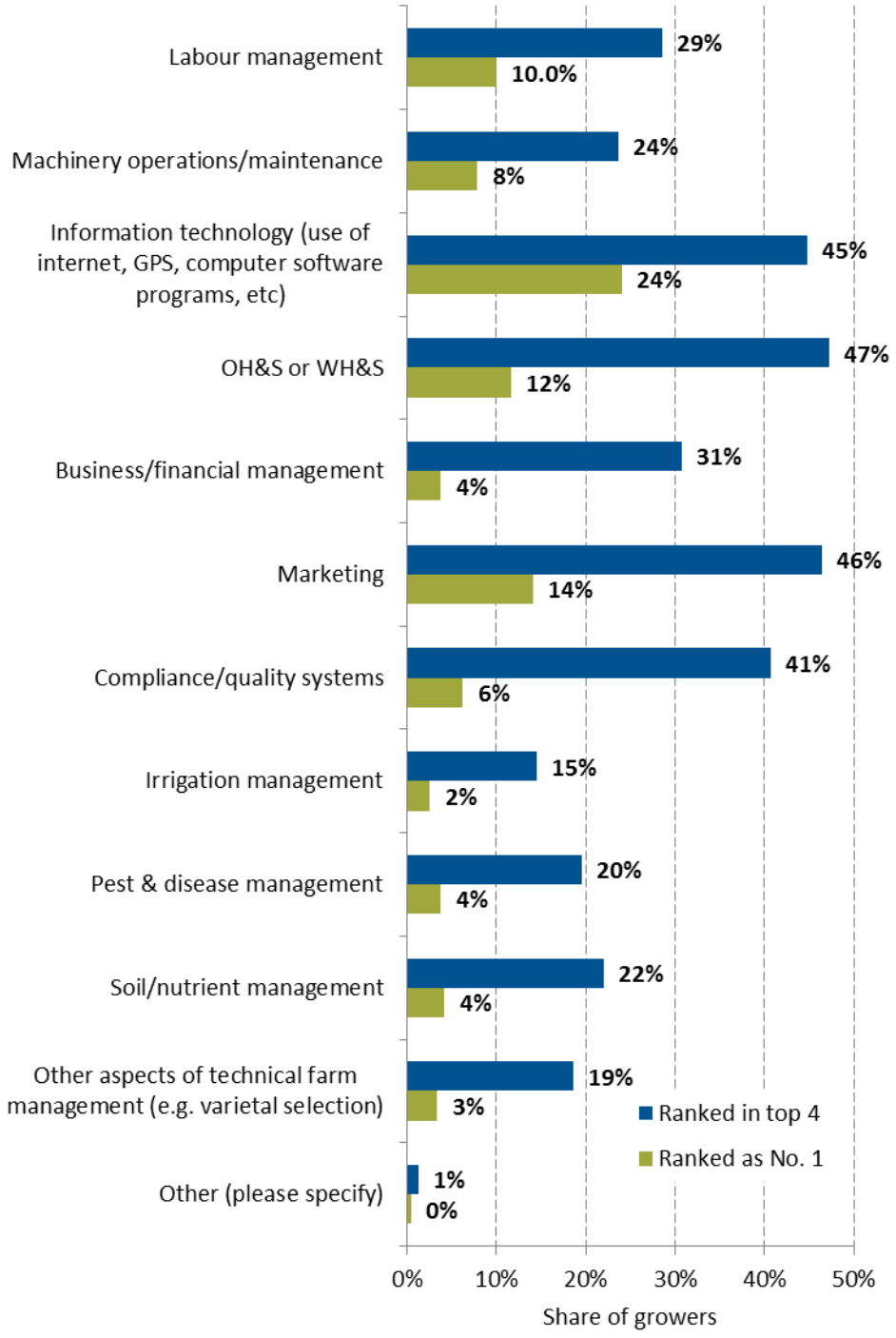


Figure 5: Grower ranking of skill weaknesses

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 4 shares do not add to 400% as 20 growers did not provide a number 1 ranking, 24 growers did not provide a number 2 ranking, 35 growers did not provide a number 3 ranking and 70 growers did not provide a number 4 ranking.)

The areas for skills improvement most commonly identified by growers as being in their top four are (Figure 6):

1. Information technology
2. Business/financial management
3. Marketing
4. Soil/nutrient management

Growers in the younger age group (<35 years) are more likely than other groups to nominate business and financial management as a skill they wish to improve. Interestingly, older growers are not more likely than other age groups to nominate information technology as their main priority for up skilling (despite nominating it as their greatest weakness).

Growers with lower educational qualifications (year 10 or below) are more likely to want to focus on training related to areas of farm management (e.g. soils, irrigation, pest and disease) – areas which also tended to be ranked by this same group as their best skills.

Growers from larger businesses are more likely than those from smaller businesses to identify labour management as a skill for improvement. They are also more likely than other businesses not to identify training opportunities.

By state, there was considerable variation in the skill improvement priorities of growers (Figure 6). For example, in New South Wales, the main priority was pest and disease management, in Victoria it was soil and nutrient management, in Western Australia and Tasmania it was Information Technology, while in Queensland and South Australia it was business and financial management.

While occupational health and safety (OH&S) was not identified as a priority area for skills improvement in the quantitative section of the survey (ranked overall as the 6th highest priority area for up skilling), it was frequently mentioned in the qualitative section of the survey and during interviews. One grower interviewed stated that '*OH&S is very stressful and would be a reason to get out of the vegetable industry*'. This view is not uncommon, and is of major concern to the industry as a whole.

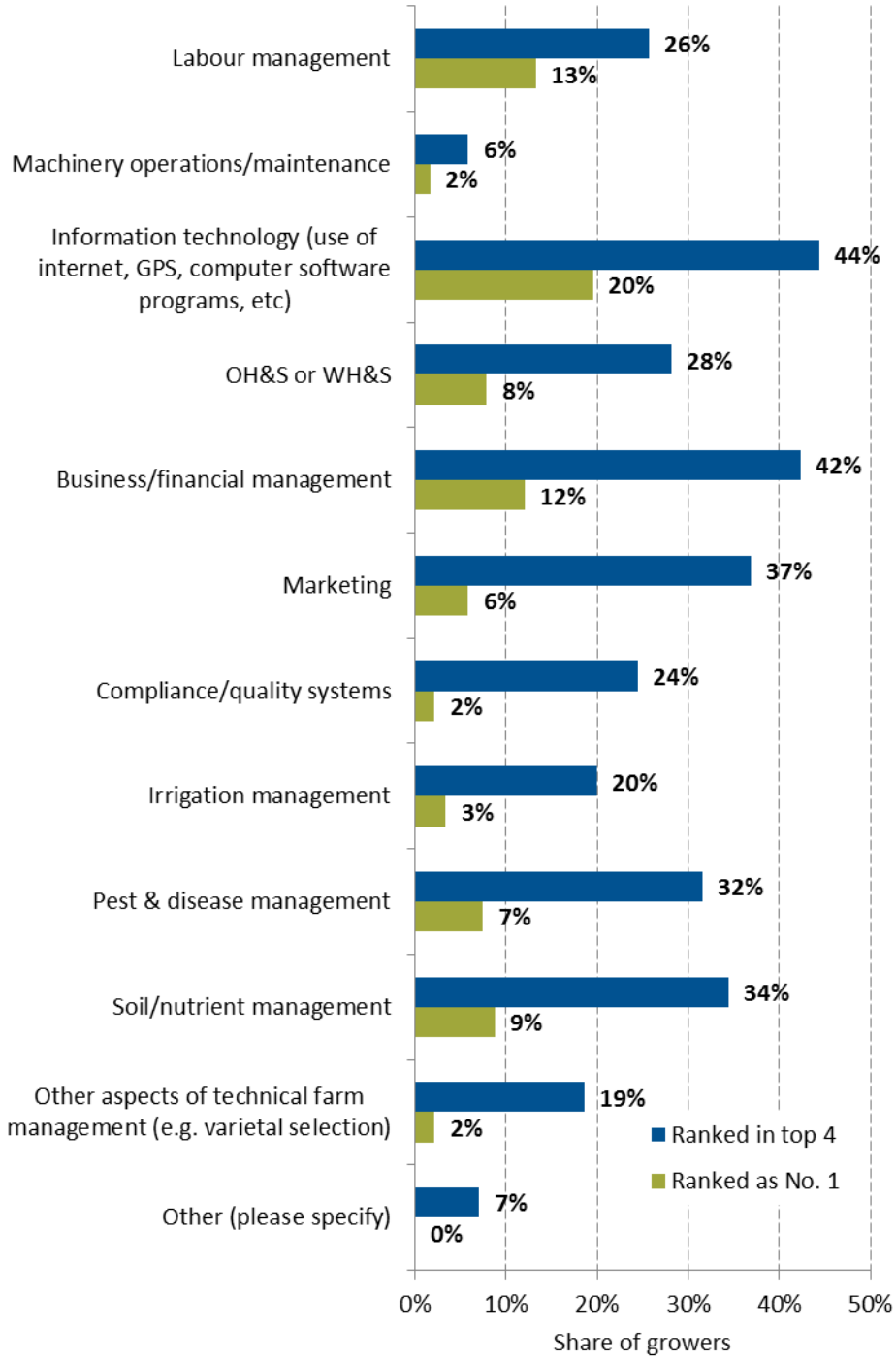


Figure 6: Growing ranking of key areas for skill improvement

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 4 shares do not add to 400% as 39 growers did not provide a number 1 ranking, 42 growers did not provide a number 2 ranking, 57 growers did not provide a number 3 ranking and 56 growers did not provide a number 4 ranking.)

3.2.2 Barriers and incentives to training

Improving profitability, production efficiency and business management are the three key factors that motivated growers to undertake training (Figure 7).

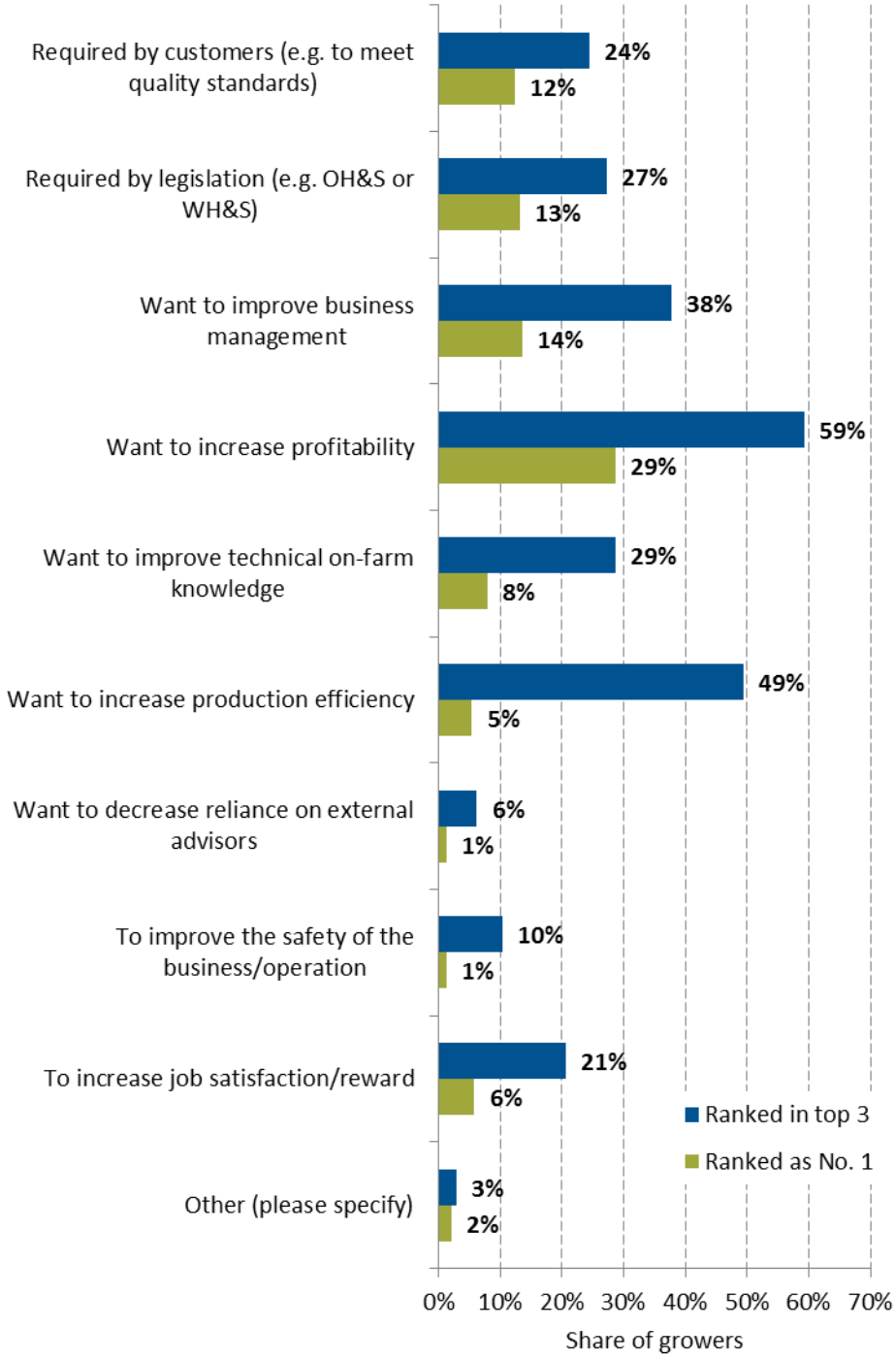


Figure 7: Grower ranking of the main factors that motivate participation in training

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 20 growers did not provide a number 1 ranking, 26 growers did not provide a number 2 ranking and 30 growers did not provide a number 3 ranking.)

The major barriers to participating in training are time constraints, training not available at a suitable location and training not available at a suitable time of year (Figure 8). However, ranking of barriers was influenced by educational qualifications – growers with year 10 or below qualifications were more likely than other qualifications to be discouraged by the course content being too academic or not practical enough. Growers who had completed a bachelor degree are more likely to be discouraged by the quality of training providers.

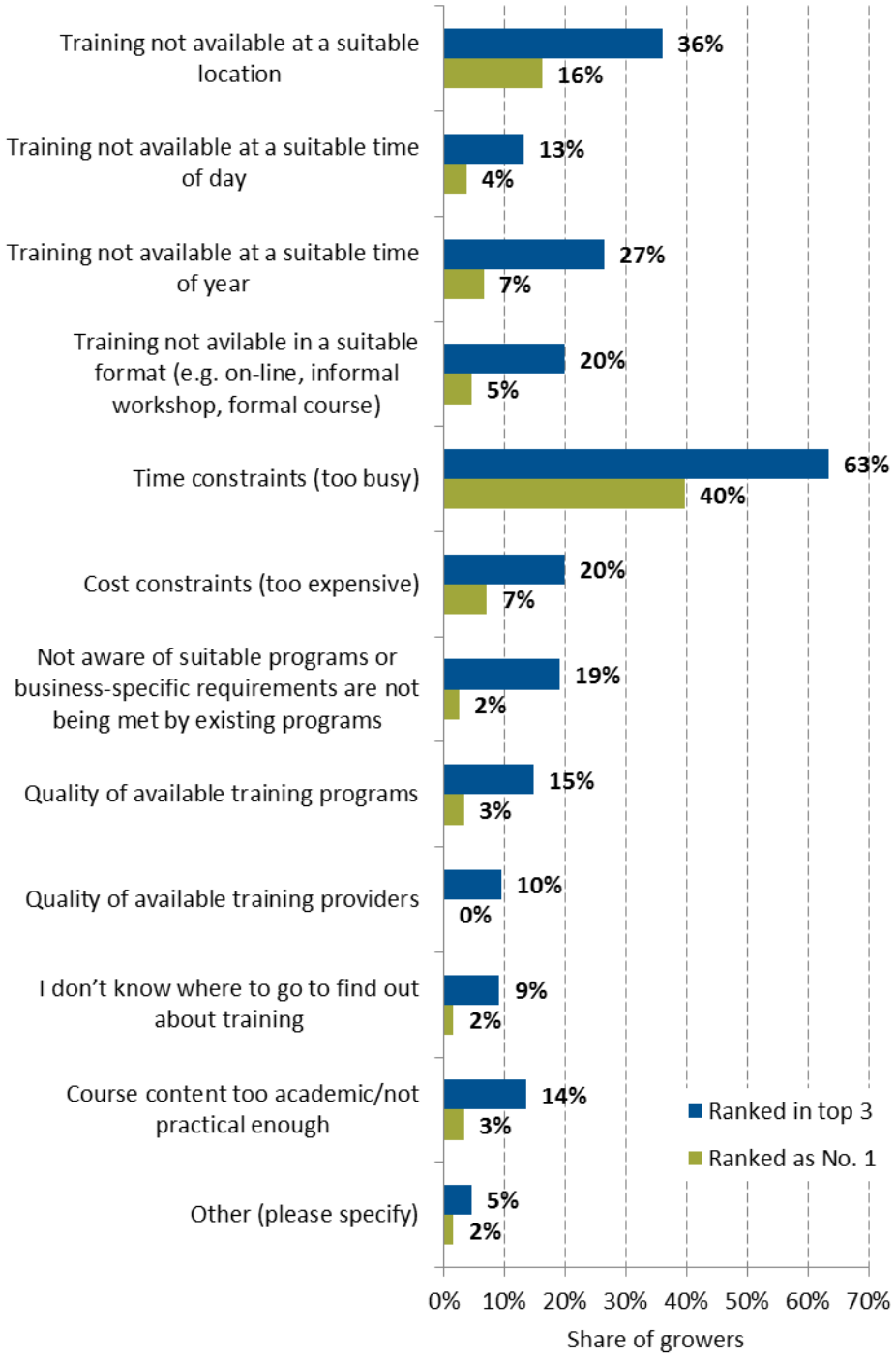


Figure 8: Grower ranking of barriers to participating in training

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 23 growers did not provide a number 1 ranking, 37 growers did not provide a number 2 ranking and 60 growers did not provide a number 3 ranking.)

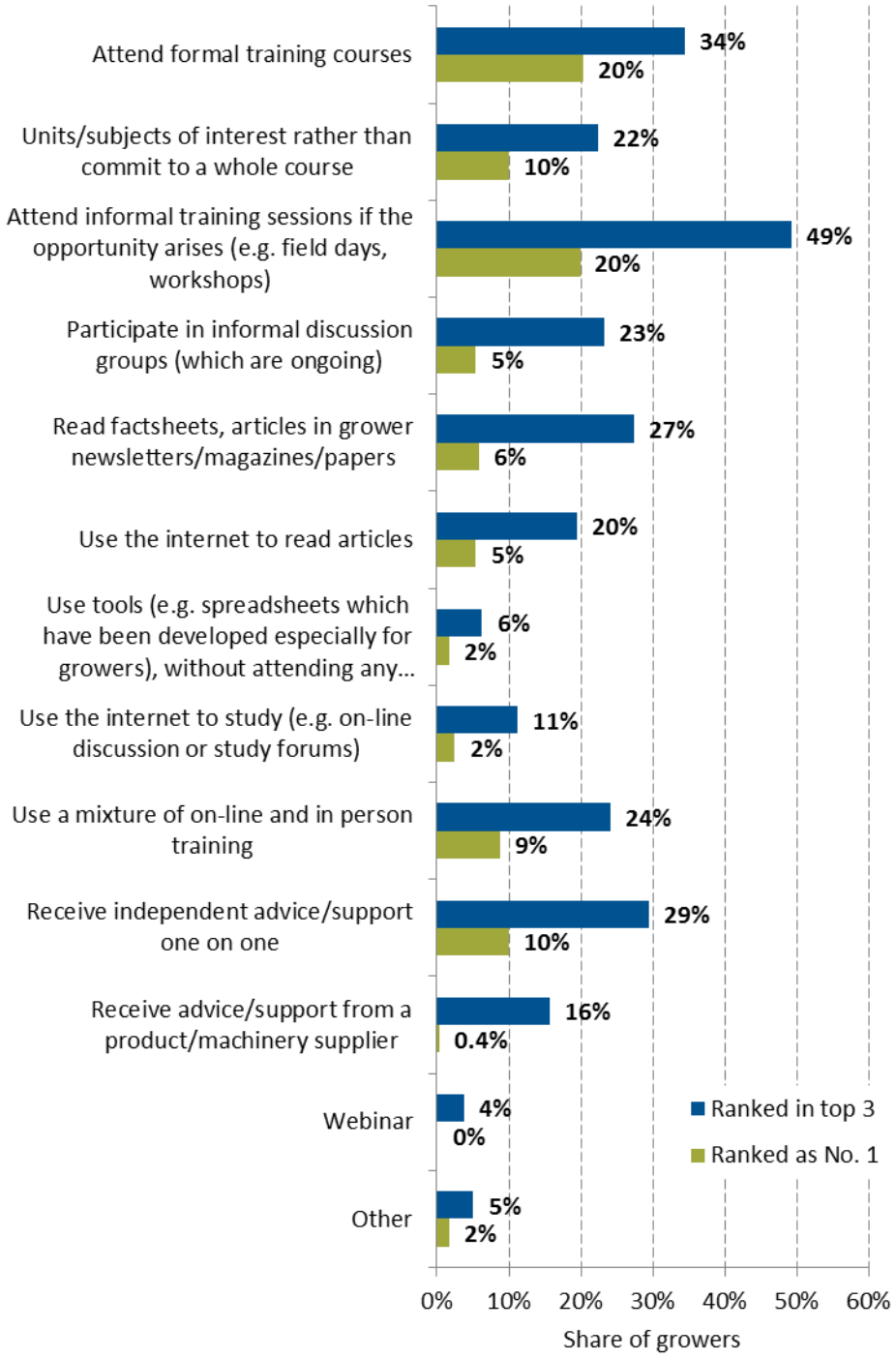


Figure 9: Grower ranking of their top 3 preferred ways of learning

(Sample size =241; Ranked as No. 1 shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 20 growers did not provide a number 1 ranking, 22 growers did not provide a number 2 ranking and 26 growers did not provide a number 3 ranking.)

The top three ways in which growers prefer to learn are (Figure 9):

1. Attend informal training sessions (e.g. field days, workshops)
2. Attend formal training courses
3. Receive independent advice/support one on one

The preferred way of learning did vary depending on age – those in the under 51 age group are more likely to identify use of the internet as a tool for study. Educational status and business size also influenced the way growers prefer to learn – for example those with year 10 or below or businesses with fewer than 5 permanent employees are both less likely to prefer formal courses. LOTE growers were more likely than English speakers to nominate their preferred way of learning as receiving one on one advice/support.

The main training providers that growers had used in the last 2 years were (in order of popularity); information shared by agricultural advisors/consultants, private Registered Training Organisations RTOs), Department of Agriculture/Primary Industry and state industry bodies (Figure 10). Grower educational status did influence the training providers used - those who had completed a diploma were more likely than others to use VET providers, while those who had completed a bachelor degree were more likely to use training provided on the job by other workers. Age also had an influence on training provider used. Growers aged under 35 were more likely to use training provided on the job by other workers, while those in the 36-50 age group were more likely to use a university/specialist agriculture college.

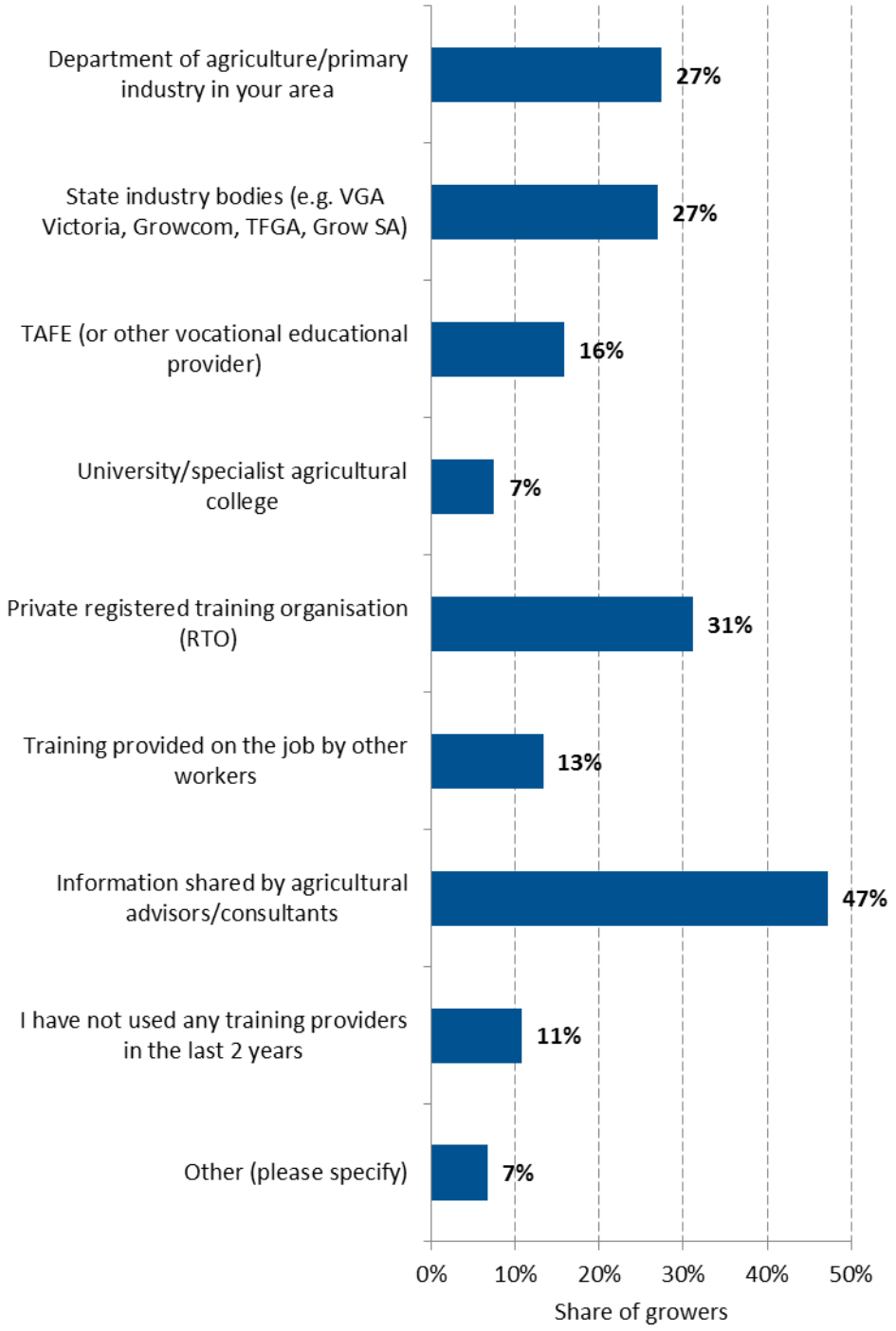


Figure 10: Training providers used by growers in the last 2 years

(Sample size = 241; share of growers do not add to 100% as multiple responses permitted & 39 growers did not record a valid response to this question)

Learning tools such as farmer case studies and benchmarking discussion groups are valued by growers to differing extents – case studies were seen as a very valuable tool, while discussion groups less so (Figure 11 and Figure 12). Grower comments during interviews indicated that discussion groups as a concept are valued but that the industry is too competitive for growers to work constructively in this context.

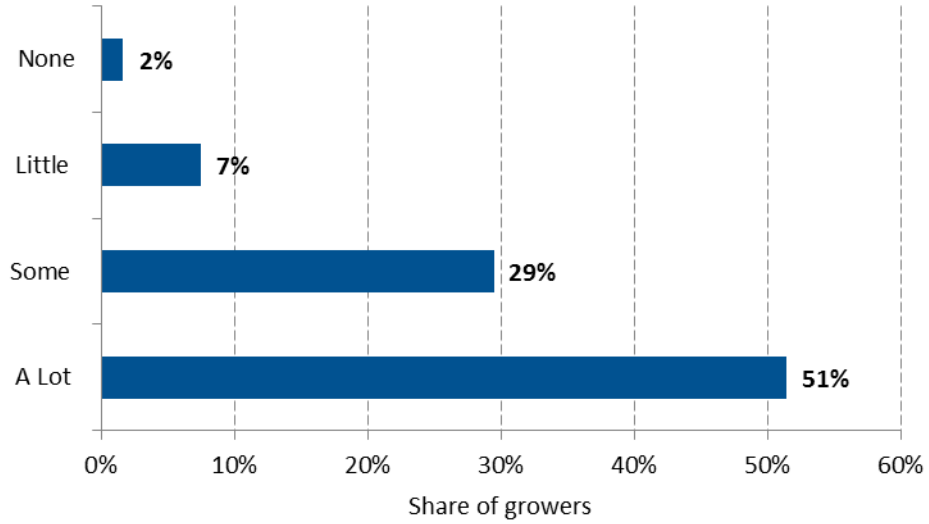


Figure 11: Grower rating of the value of case studies as a learning tool

(Sample size = 241; share of growers may not add to 100% as 23 growers did not record a valid response to this question)

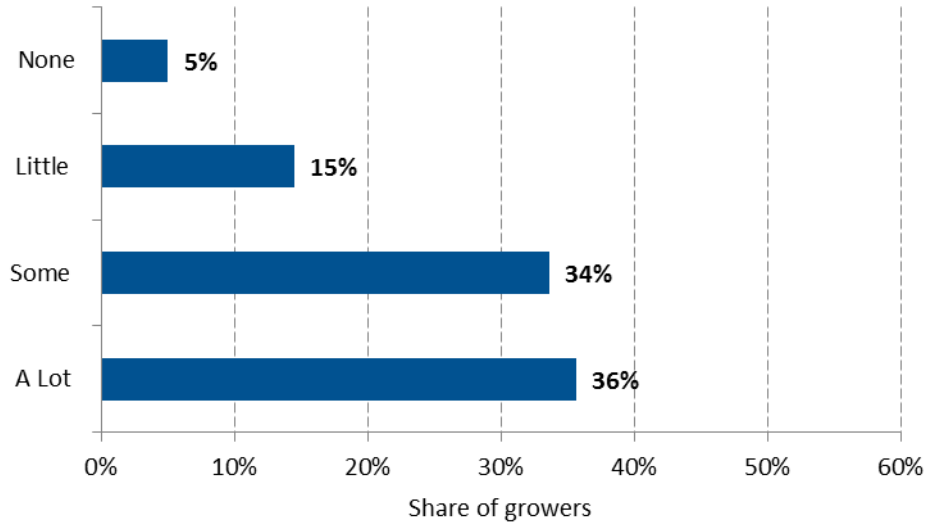


Figure 12: Grower rating of the value of benchmarking/grower discussion groups as a learning tool

(Sample size = 241; share of growers may not add to 100% as 23 growers did not record a valid response to this question)

The survey indicated that approximately 82% of growers use an iPhone/smart phone (Figure 13). Interviews with growers indicated that Apps are increasingly being used for business purposes by farmers. 29% of growers indicated that they actively search in the internet for tools for a specific problem, while 12% would prefer to ask an extension officer/advisor (Figure 14). 21% of growers will use tools only if introduced to them. 16% growers indicated that they never use tools while in contrast to this 10% develop their own tools as they need them.

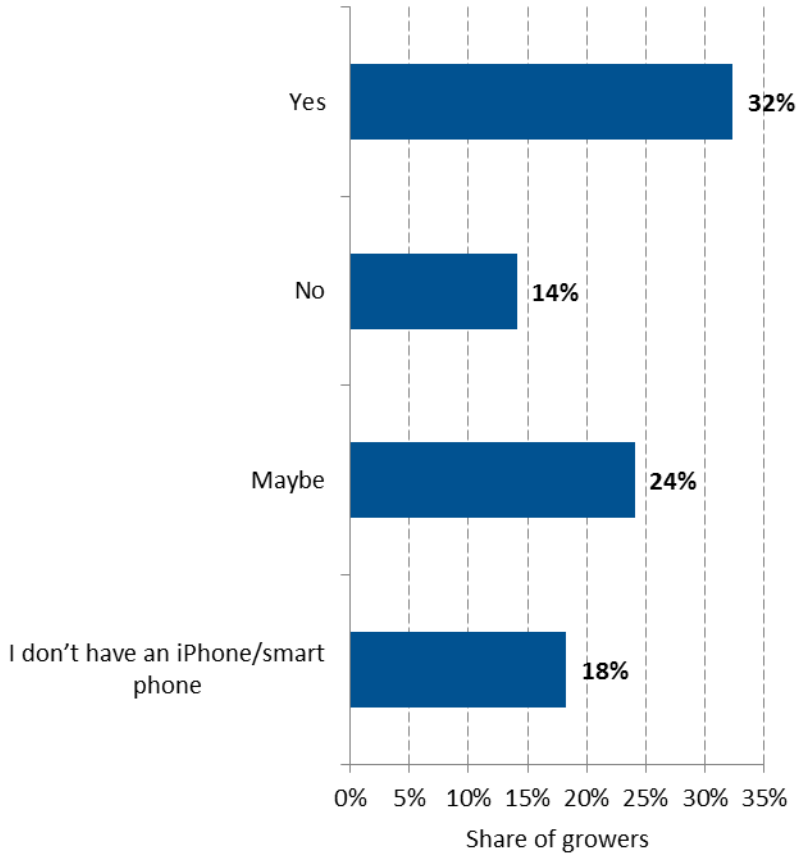


Figure 13: Response of growers to using tools in App form and available on iPhone/smartPhone

(Sample size = 241; share of growers may not add to 100% as 26 growers did not record a valid response to this question)

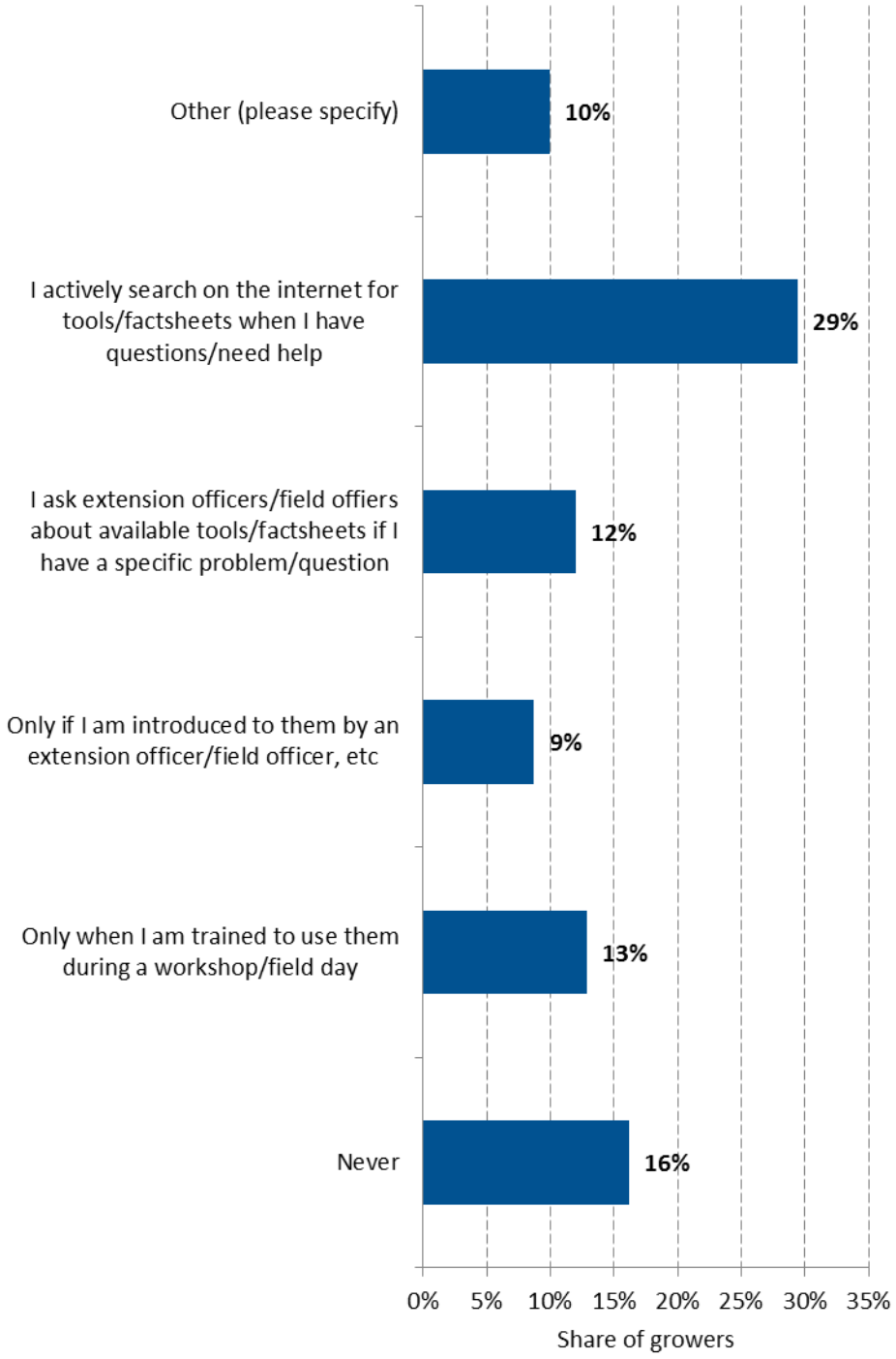


Figure 14: Types of use of industry learning tools

(Sample size = 241; share of growers may not add to 100% as 26 growers did not record a valid response to this question)

The key ways in which Research and Development is extended to growers are (in order of popularity), articles in newspapers/magazines, external advisors, and at workshops/field days (Figure 15). Those in the over 51 age group or growers with year 10 and below qualifications are more likely than other age group/qualifications to learn about R&D from neighbours/friends. Those who had a diploma were more likely than other qualifications to access information about R&D through webinars, and those with a bachelor degree were more likely to access information from field days and government agriculture/primary industry departments, than those with other qualifications.

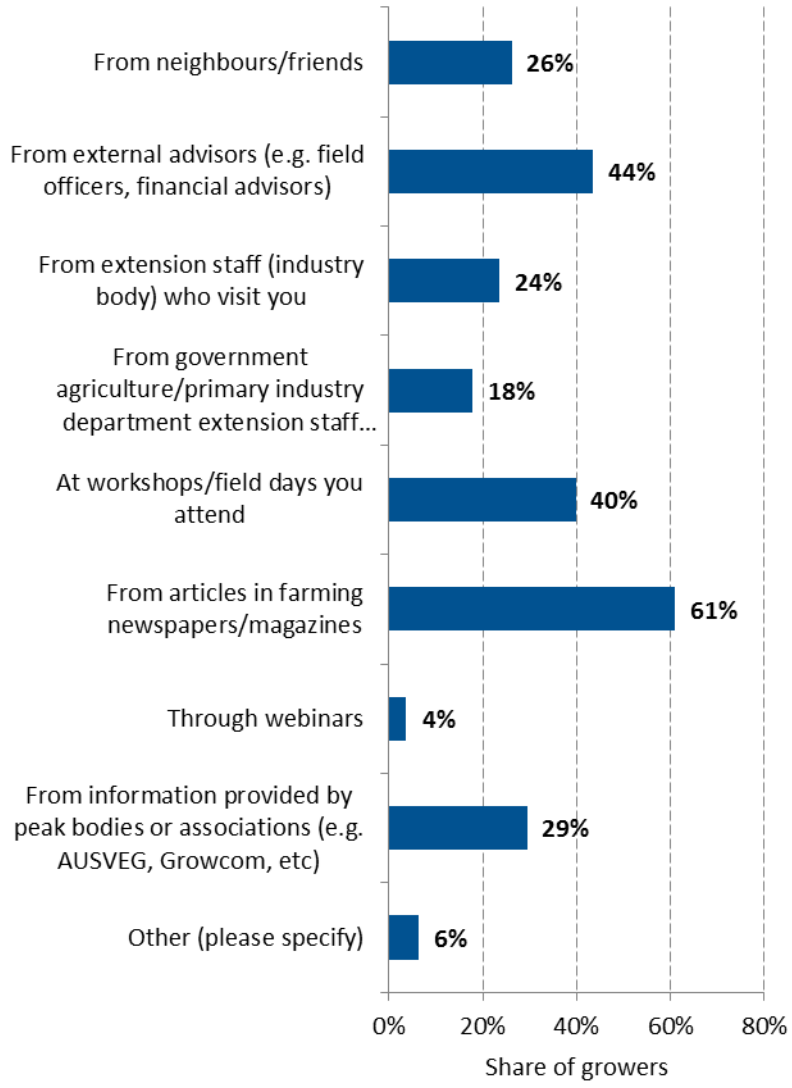


Figure 15: Ways in which growers learn about R&D outcomes

(Sample size = 241; share of growers may not add to 100% as multiple responses permitted and 33 growers did not record a valid response to this question)

The grower survey found that growers from Tasmania and NSW were less likely to have attended a training course in the last 2 years compared to growers from WA and Queensland (Table 4). Consistent with preferred ways of learning, informal training opportunities such as seminars/information sessions and field trips were the most frequently attended training activities, followed by formal certification courses. The large numbers of growers from WA that listed courses/sessions that they had attended, compared to growers from all other areas of the country, suggests that there may be lessons to learn from the extension model being used in WA.

Table 4: List of training programs/courses, field days, or workshops that growers noted as attending in the 12 months prior to the survey

Type of course	Includes, for example	WA	VIC	TAS	SA	QLD	NSW	Total
Seminars and information sessions	*Potato research updates, information sessions, supplier product training, vegetable specific training, Servag, Simplot, Coles, technical skill workshops*	24	5	1	5	12	5	**52**
Field days, trips and tours	*Soil nutrition, Agfest, Macgroups, shows, Farm World, trade shows*	22	8	1	5	9	6	**51**
Certification courses	*Agsafe, Chem Cert, HACCP, weights and measures, NTS Certificate in Sustainable Agriculture, Freshcare, OHS, fork lift training, first aid, machine operator licence, workplace standards, WHS*	18	4	1	5	12	5	**45**
Industry body conferences and networks	*Women's coalition, Ausveg conference, SIP, QDPI young growers, women in horticulture*	3	7	0	8	9	2	**29**
Professional development courses	*Taking a leap, growing leaders, Streamwise, MYOB, plan prepare, prosper*	4	2	0	2	6	1	**15**
Industry discussion groups and meetings	*Extension workshops, discussion groups, horticulture group, almond growers group, climate ready leaders, project groups*	6	4	0	3	1	1	**15**
Forums and non-specific workshops	*Carbon Farming, agribusiness, climate change adaptation, sustainability*	7	2	1	0	2	1	**13**
VET, Diploma course	*Various agriculture diplomas and one Certificate III course*	3	2	0	1	2	0	**8**
Webinars and online workshops	*Women in melon, Learning management systems for the web*	2	3	0	1	1	0	**7**
Advisory groups	*Panels*	0	0	0	1	1	0	**2**
Total		**89**	**37**	**4**	**31**	**55**	**21**	**237**

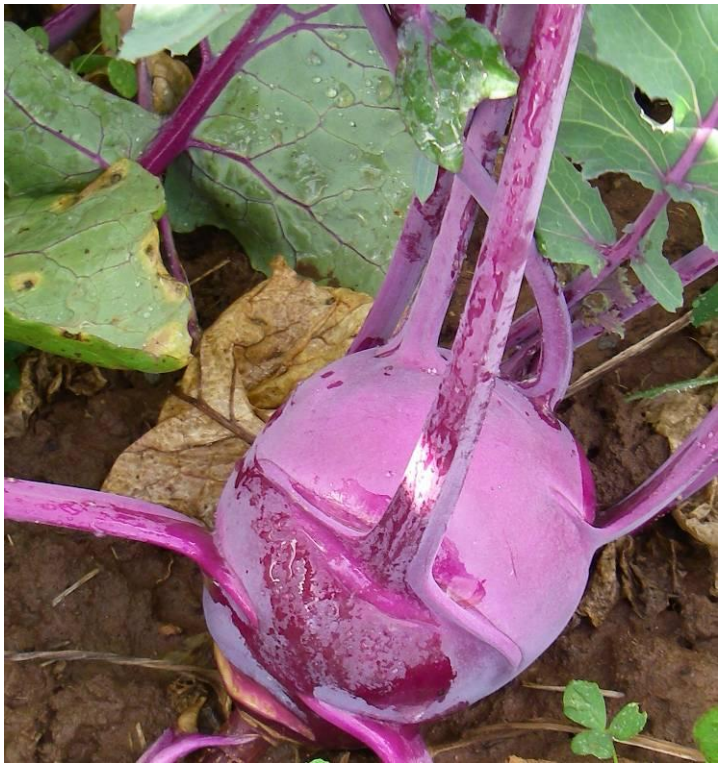
(Sample size = 241; 10 growers indicated that they did not attend any training programs or courses in the last 12 months; 88 growers did not respond to this question)

There was very little variation in the use of tools by growers in different states, except in the case of NSW growers who the data suggest use fewer tools than growers in other states (Table 5). Factsheets were by far the most popular training tool used by growers, with farm management tools the next most used tool, followed by case studies and internet sources.

Table 5: List of training tools that growers noted as using in the last 12 months

	NSW	QLD	SA	TAS	VIC	WA	Total
Advisers	0	0	0	0	1	1	2
Case studies	0	2	2	1	3	1	9
Farm management tools	2	2	4	2	3	2	15
Financial management tools	1	0	2	2	1	0	6
Internet sources	0	1	2	2	1	3	9
Magazine articles and newsletters	1	1	1	1	2	0	6
Own tools	2	0	1	0	0	2	5
Trade fairs and shows	0	0	0	0	0	1	1
Training manuals	0	1	0	0	0	1	2
Trials, R&D reports	0	1	0	2	1	1	5
Fact sheets	6	9	8	9	9	5	46
	12	**17**	**20**	**19**	**21**	**17**	**106**

(Sample size = 241; 22 growers indicated that they did not use any training tools in the last 12 months; 130 growers did not respond to this question)



3.2.3 Employee skills and training

By far the greatest numbers of businesses surveyed were in the small business category (0-5 employees) (72%). Medium sized businesses (6-20 employees) made up 15% of the respondents and large sized businesses (21 or more employees) 13% (Figure 16). Unfortunately it is not possible to compare this distribution of business size to that of the industry as a whole, as permanent employees include both full time and part time employees whereas the ABS data separates part time and full time employees.

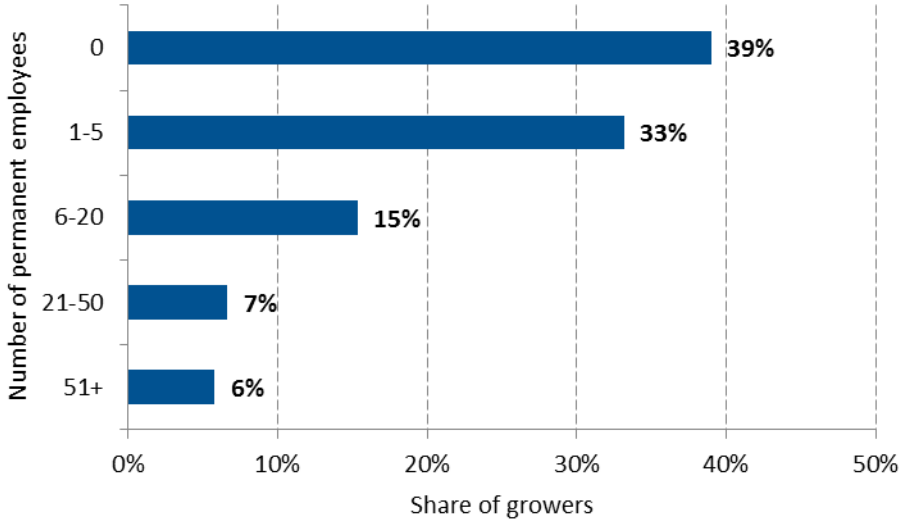


Figure 16: Maximum number of permanent (full time or part time) employees

(Sample size = 241; share of growers may not add to 100% as 63 growers not responding to this question were recorded as having no employees)

Very few apprentices are currently employed in the vegetable industry (Figure 17). During interviews many growers indicated that they either had employed apprentices in the past or that they would be interested in employing one in the future, but that young people are not interested, or growers did not get enough benefit out of the arrangement.

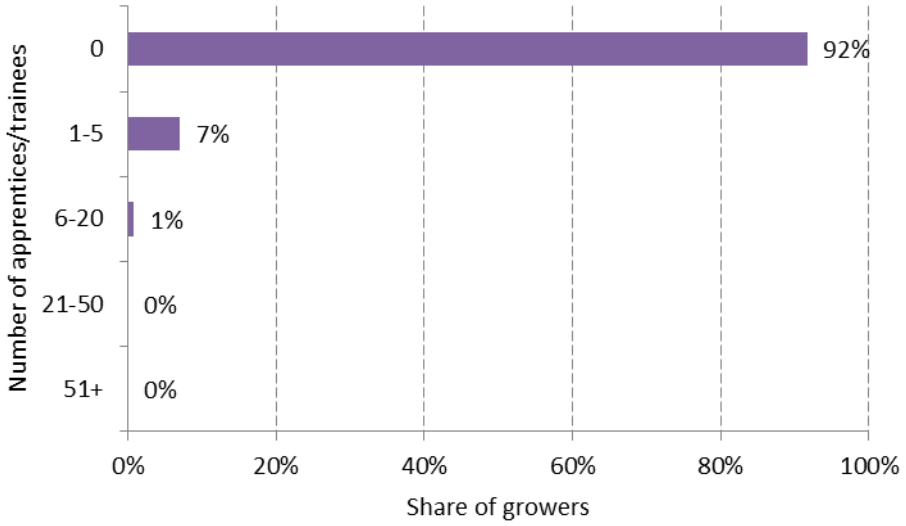


Figure 17: Numbers of apprentices/trainees employed

(Sample size = 241; 156 growers not responding to this question were recorded as having no apprentices or trainees; 1 grower did not respond to this question)

The interviews indicated that a large number of vegetable growers throughout the country rely heavily on LOTE workers in both casual and permanent positions. These come from a variety of backgrounds and many speak and read English poorly (and sometimes are not literate in their own language).

Good work ethic, willingness to learn and previous practical on-farm experience were the most important attributes, skills and qualities desired in new employees (Figure 18). Qualifications (licence/ticket to operate and formal VET qualifications) were of secondary importance (ranked 5 and 8, respectively, out of 8 choices). The ranking of employee attributes did vary depending on the size of the business, grower age and qualifications.

The interviews highlighted than having access to a pool of unskilled labour with a good work ethic is critical to the ongoing survival of the vegetable industry

'*90% of the workforce is unskilled and this is what is needed*'

'*unskilled staff are important to business functioning*'

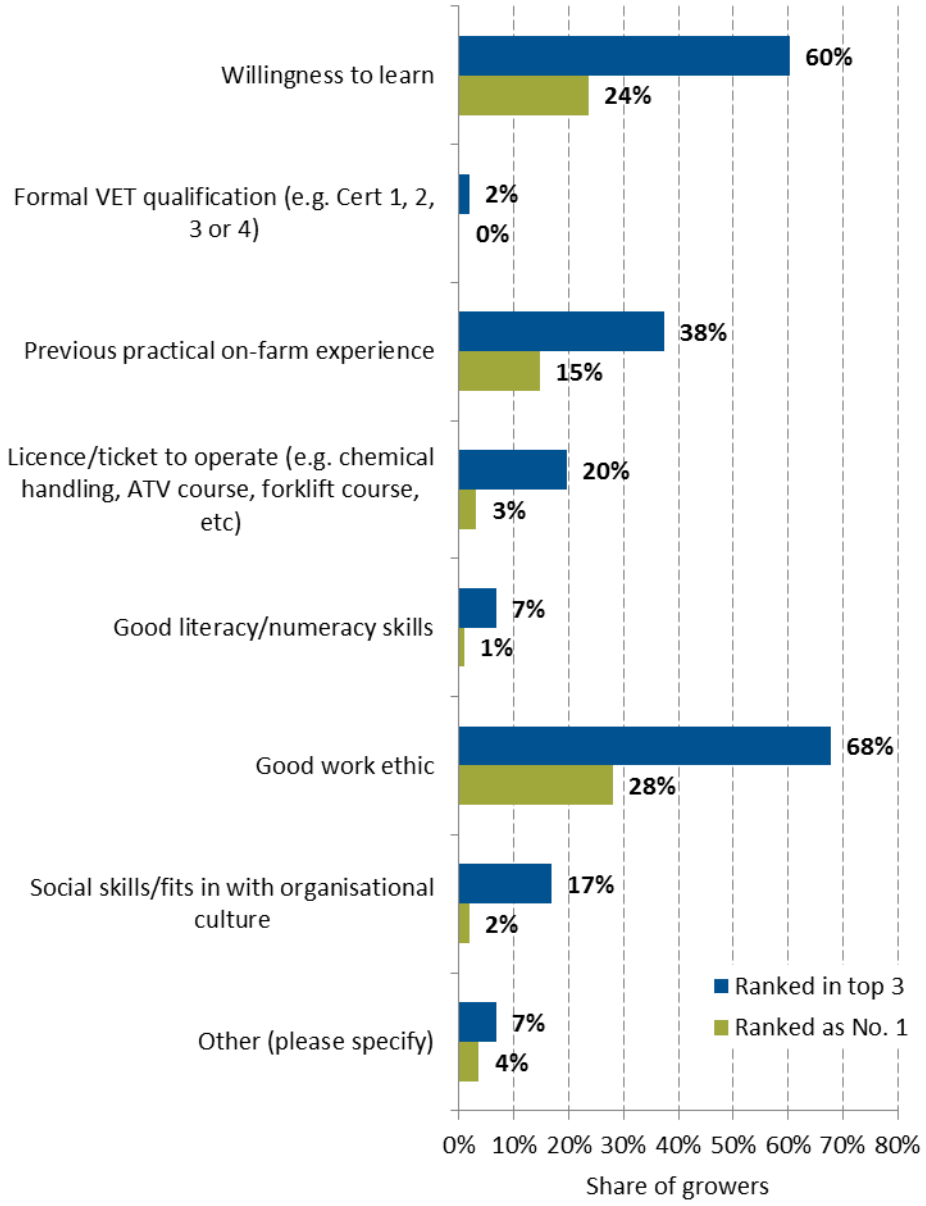


Figure 18: Ranking of the main skills/qualifications/attributes required in a new employee

(Sample size = 224; Ranked as No. 1 shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 54 growers did not provide a number 1 ranking, 59 growers did not provide a number 2 ranking and 72 growers did not provide a number 3 ranking.)

The main type of training that staff undertake (in priority order) are (Figure 19):

1. Informal on the job training
2. Structured on the job training
3. Formal course

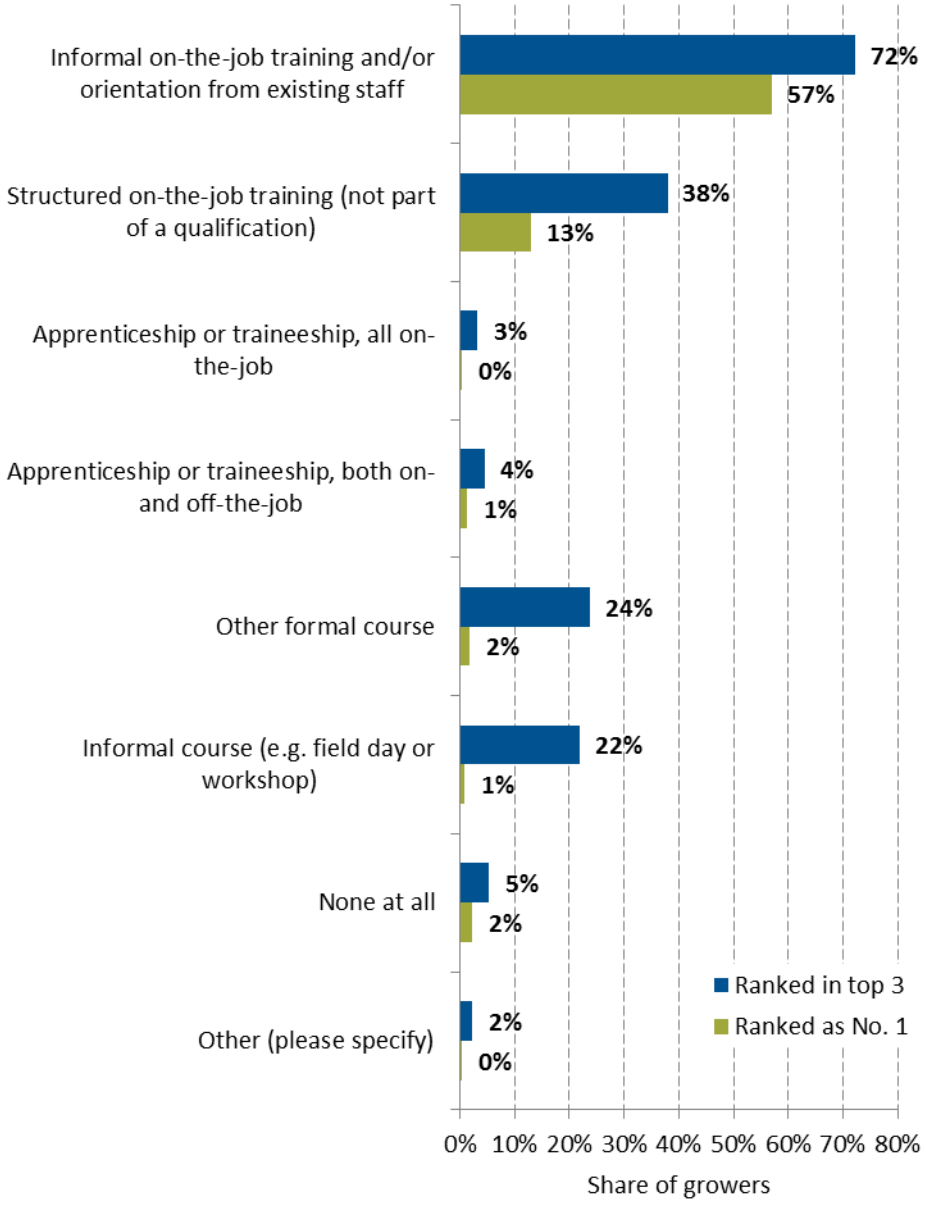


Figure 19: Ranking of the main type of training that staff undertake

(Sample size = 224; Ranked as No. shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 51 growers did not provide a number 1 ranking, 83 growers did not provide a number 2 ranking and 155 growers did not provide a number 3 ranking.)

Small businesses (<5 employees) are more likely to offer no training at all for employees, large and medium sized business are more likely to use informal on the job training and formal courses.

The most important reasons given for providing training for staff (in priority order) are (Figure 20):

1. To improve business efficiency
2. To improve the quality of products or services
3. Legal, award or other requirement

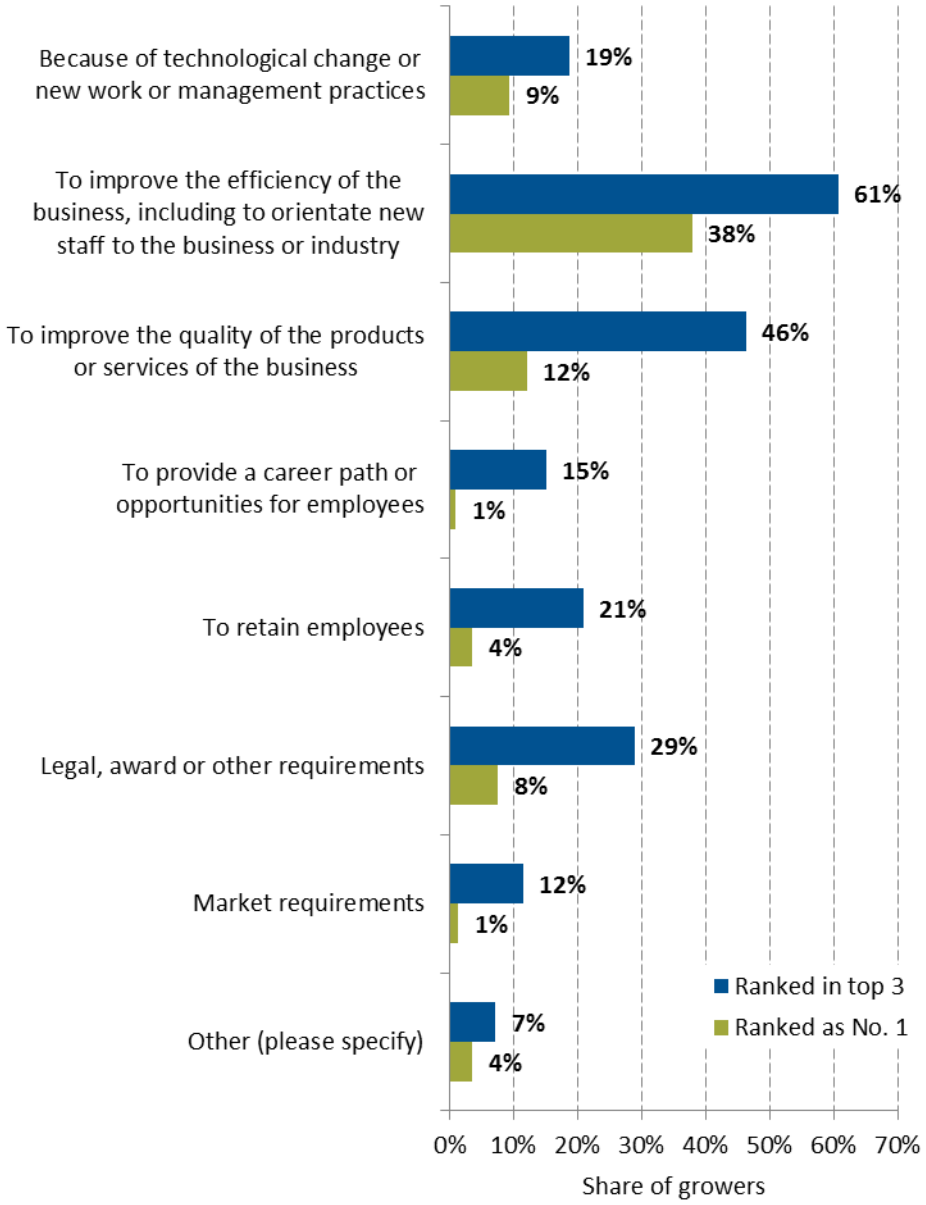


Figure 20: Ranking of reasons growers gave for providing training for staff

(Sample size = 224; Ranked as No. shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 53 growers did not provide a number 1 ranking, 68 growers did not provide a number 2 ranking and 81 growers did not provide a number 3 ranking.)

Growers with year 12 or diploma qualifications are more likely to provide training to give career path opportunities for employees, than growers with other qualifications. Those with TAFE/VET certificate are more likely to provide training for staff to meet legal award or other requirements.

Factors which would encourage growers to provide more training for staff (in priority order) are (Figure 21):

1. Improved business profitability
2. More courses relevant to the business
3. Subsidies or other financial incentive

Small and medium sized businesses are more likely to offer training to staff if subsidies are available. Growers with large sized businesses are more likely to offer training for staff if there are more on the job training opportunities.



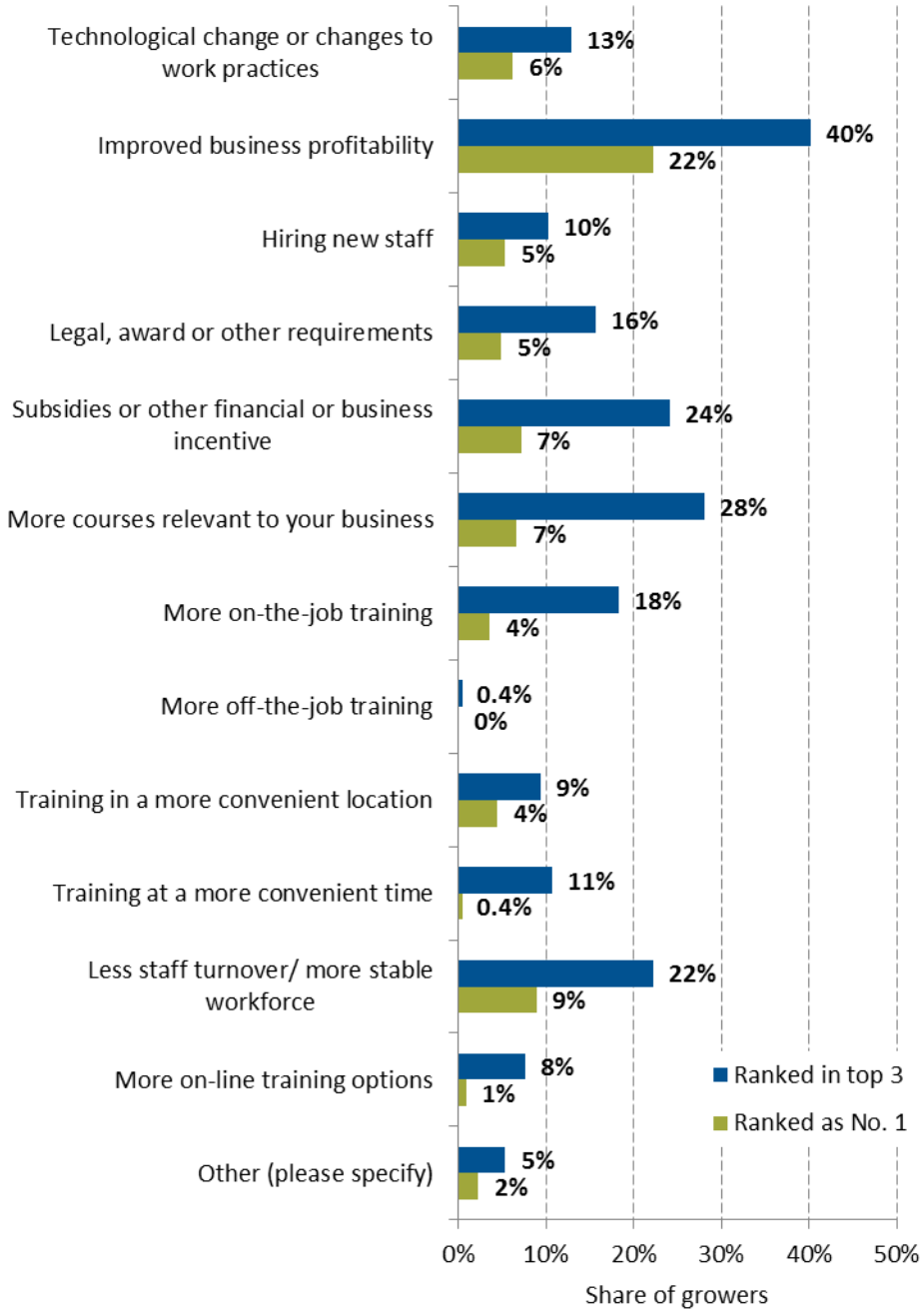


Figure 21: Ranking factors which encourage growers to provide training for staff

(Sample size=224; Ranked as No. 1 shares do not add to 100% and Ranked in top 3 shares do not add to 300% as 60 growers did not provide a number 1 ranking, 71 growers did not provide a number 2 ranking and 81 growers did not provide a number 3 ranking.)

3.2.4 Vocational education and training (VET)

Both the quantitative data and the interviews highlighted that many of the VET courses on offer are not meeting the needs of the vegetable industry (Figure 22). While this applied to both TAFE and private RTOs, TAFE was more frequently identified as not providing adequate training than private RTOs. There was no difference between states in the level of satisfaction with VET training. Key criticisms include:

1. Courses not specific/relevant to vegetable industry
2. Courses not practical
3. Trainers are not experienced or industry based
4. Coordination between institution and employer is poor
5. Courses are too long

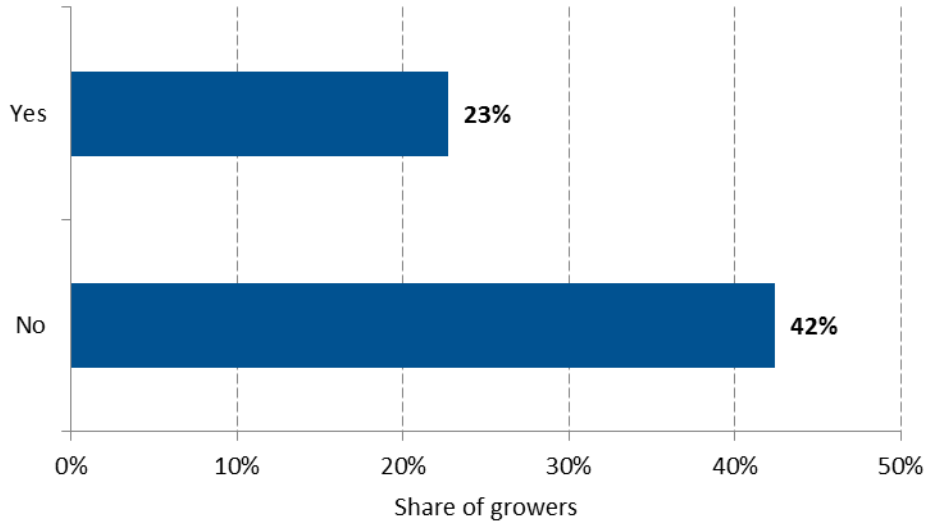


Figure 22: Grower assessment on whether the range of VET courses on offer at TAFE/RTO/etc meet up skilling need

(Sample size = 224; share of growers may not add to 100% as 78 growers did not record a valid response to this question)

4 Discussion

In order to fully inform key recommendations on vegetable industry needs with respect to skills and training, the results obtained from the grower survey are discussed in conjunction with findings from the desktop study.

4.1 Training and skills needs

4.1.1 Business management

During the desktop study, a lack of business and marketing skills among vegetable growers was nominated by many state-based organisations as a key factor limiting industry growth and development. This has also been highlighted by previous studies (AgriFood Skill Australia – Business Skills Project (2009)[3] and Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development (2007)[4]). The desktop study also revealed that while there are many extension and training activities which cover on-ground technical aspects of farming and legal requirements (e.g. OH&S or WH&S), there are limited opportunities for training in business skills. The results from the grower survey also highlighted a large skills gap in business management and marketing, with this being the second highest priority overall for skills improvement. Improving business skills is a higher priority for younger growers (under 35) than older growers.

'*business skills are more important for young farmers now than agronomic skills. It is critical that they run a profitable business*'

4.1.2 Occupational Health and safety (OH&S)

Although the desktop study identified that there were extension and training activities which covered occupational health and safety (OH&S), the grower survey found that OH&S was ranked overall as their weakest skill. While it was not identified as a focus for skill improvement in the quantitative section of the survey, OH&S was a theme that emerged very strongly during interviews with growers, and is an area of major concern to the industry.

While business of all sizes would benefit from OH&S training, based on the analysis those who would benefit most are smaller businesses (with up to five employees) (and medium sized businesses (5-20 employees), to a lesser extent). These businesses are less likely to have systems in place to ensure workplaces and practices comply with relevant regulations, and include a range of age groups and levels of industry/educational experience.

[3] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

[4] Australian Vegetable Industry Development Group 2007, Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development, prepared by Dianne Fullelove.

'*often growers don't realise where the gaps are until there is an incident*'

Another group who frequently nominated OH&S issues are growers with workers who speak languages other than English (LOTE). Several comments in relation to this group suggested that growers struggled to instil values of workplace health and safety among particular non-English speaking cultural groups. Their needs are therefore for resources that ensure that workers understand their obligations to work in a safe manner. Hence, growers were interested in OH&S training opportunities not only for themselves but also for their staff.

In addition to training, growers also require ongoing access to resources and information on OH&S, particularly as legislation and obligations in this area change. In the interviews growers indicated that a 'manual' covering vegetable industry OH&S responsibilities and ways in which these obligations should be met would be a valuable tool for them.

'*too many grey areas and lots of confusion*' among growers; '*one off training sessions in OH&S aren't that effective, need follow up to support people with making changes*'

4.1.3 Information Technology

During the desktop study, industry representatives painted a mixed picture of computer literacy rates among vegetable growers. The grower survey supported this, with notable differences in computer literacy depending on either age or educational qualifications. Overall, information technology was ranked as one of the weakest skills by growers and was the number one priority for skills improvement. However, although older growers were significantly more likely to rate it as their greatest skill weakness they weren't more likely than other age groups to rate it as a high priority for skill improvement.

Use of the internet to read articles was well down the list of ways in which growers prefer to learn. While for some growers the internet was their main mechanism of solving problems or answering questions, for others relying on human contact and networks was far more important. Some growers preferred the internet as a method of study – mainly due to the flexibility and being able to study when it is convenient. It is likely that study and learning options on the internet will increase in future – with some growers already identifying forums that they have participated in (for example Women in Melon). However, it will be important to ensure that those who are less familiar/competent with the internet are not excluded from learning opportunities.

The desktop study indicated that some growers are 'skipping' the internet and going straight to iPhone/smart phone technology. ABARES 2006-07[5], in a survey of vegetable farms throughout Australia, indicated that an estimated 82% of vegetable growers used a computer during 2006-07. The current survey indicated that approximately 79% of growers use an iPhone/smart phone. Interviews with growers indicated that Apps are increasingly being used for business purposes by

[5] Crooks, S 2009, Australian vegetable growing farms: an economic survey, 2006-07, ABARE Report to Horticulture Australia Ltd, Canberra, January.

farmers – for receiving customer orders, for checking the weather, etc, and some businesses provide them to employees for submission of timesheets etc.

'*moving to ipads in tractors for record keeping*'

4.1.4 Leadership, management and communication

While the survey did not specifically ask about leadership, management and communication skills, this skill set was covered to some extent by questions to do with labour management. Although labour management was not identified as a focus for skill improvement by growers overall in the survey, for growers from larger businesses labour management was more frequently identified as a skill for improvement. In addition, leadership, management and communication skills came to prominence in the interviews especially in relation to management and supervision of workers (in medium to large sized businesses).

'*labour is our biggest cost...we need good efficiency...and good supervisors*'

People management skills have been identified previously as lacking in the agriculture sector (AgriFood Skill Australia – Business Skills Project (2009)[6]).

In the case of those supervising LOTE workers, people management and communication skills become even more important. Growers reported using LOTE speakers as team leaders to effect better communication with the workforce. However, these team leaders, while having the necessary language skills often had difficulty with leadership and labour management skills.

Examples of initiatives that some growers use within their business to improve performance are:

- Focus on Key Performance Indicators (KPI) within work teams to ensure teams are meeting targets
- Providing awards to teams/staff members at regular intervals for achieving or exceeding KPI, for suggestions to improvements in processes, etc

4.1.5 Marketing and promotion

There are two issues that emerge from the analysis of data in relation to marketing. One relates to the marketing of farm products. The second relates to industry promotion and development more generally.

Marketing of farm products was identified in the survey both as a skill weakness (ranked second overall) and a priority area for skills improvement (ranked three overall). There are a range of marketing skills needed by growers including supply chain management, business development, and business/product promotion. In many areas of the country where vegetables are grown (e.g. South Australia, Victoria and NSW) wholesale markets continue to play a major role in the sale and distribution of fresh vegetables. Growers' interaction with their customers at these markets has been a cornerstone of business marketing. However the role and function of these markets have

[6] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

changed and they are likely to continue to do so in the future, meaning the way in which many growers have traditionally marketed and managed their supply chains will also need to change. In addition, some medium to large size businesses (particularly fresh market growers) feel the need to improve their marketing skills due to now dealing direct with the retailers themselves (the wholesaler is not longer used).

During interviews, LOTE growers identified supply chain management and accessing larger markets as a specific challenge for them – due both the cultural and language challenges.

The interview results also highlight the importance of industry promotion/development as a significant issue in relation to the use of the levy. Feedback provided indicated that growers considered good effective industry promotion to be critical for two main reasons; to encourage support for the industry from consumers (related to industry profitability) and to encourage young people to consider a career in the vegetable industry.

4.1.6 Other skills

Overall soil/nutrient management was ranked number 4 as a priority for up skilling by growers surveyed. The interviews indicated that most grower have a great interest in farming systems (e.g. irrigation, pest and disease and soil and nutrient management), and are always eager for more knowledge in this area, particularly where it is directly relevant to their crop/production system. Training courses attended in the last 12 months did show attendance at technical-farm events to be common. The survey found that growers with lower educational qualifications (year 10 or below) are more likely to want to focus on training related to areas of farm management (e.g. soils, irrigation, pest and disease) – areas which also tended to be ranked by this same group as their best skills.

4.2 Barriers and incentives to training

Discussions with state-based vegetable grower organisations right across the country indicated that there is apathy towards training by growers and in the majority of cases growers only participate in training for financial/market or legislative (e.g. OH&S) imperatives, and that the dollar value of training needs to be obvious to growers from the outset. However, while the importance of training adding to the profitability of the business was reinforced by the results from the grower survey, the significance of market/legislative requirements as training triggers was not supported. Attitude to training is a complex area - differences in attitude were apparent depending on both the age of growers and their own educational background. For example growers in the 51+ year age group appear to have a strong belief in structured training while younger growers are more interested in peer-supported learning and training on the job. There is also a perception by some growers that a ticket or licence to operate does not necessarily mean that a person is competent at the task.

'it makes no difference if an employee comes with tickets – doesn't always mean they can actually do it'

The main barriers identified to training by growers tended to be logistical (e.g. time constraints, location/time of year not suitable). The Australian Vegetable Industry Training Needs Analysis in

Business Skills & Leadership Development (2007)[7] study indicated that one of the most important considerations for attending training is convenience. The same finding has been made in this current study. The format of training and cost constraints also ranked high as barriers to training, although in the interviews many growers stated that they are willing to pay for training if it is high quality and delivers good value. This is supported by the strong uptake of study tours by growers and their willingness to travel for informal learning opportunities. Growers surveyed also indicated that they either aren't aware of suitable programs or that existing programs are not meeting their needs. All of these barriers have been identified in previous studies (e.g. AgriFood Skill Australia – Business Skills Project (2009)8.

There was some influence of demographic factors on barriers to training – for example growers with year 10 and below educational qualifications were more likely to be discouraged by courses being too academic or not practical enough. The demand among growers for experiential/hands on learning has been identified in previous studies (AgriFood Skill Australia – Business Skills Project (2009)[9]), and should be a key factor in designing any kind of grower training program, formal or informal.

Improving profitability, production efficiency and business management are three key factors that motivate growers to undertake training. If growers can clearly see the value of training to their business then they will make the effort to attend:

'*it is really hard to make the time for training and you must be really passionate and enthused by the subject to make the effort to go to training*'

4.3 Methods of learning

Both the top three ways in which growers prefer to learn and the selection of training providers used by growers in the past 2 years indicated a mixture of formal and informal learning is undertaken. During interviews growers indicated that the method they prefer for learning varies depending on what is being studied – for example some subjects lend themselves more to distance/internet study while others require face to face contact. However, grower demographics also had a large influence on the preferred learning method (for example younger growers are more likely to nominate the internet as a preferred means of study).

The majority of state grower representatives noted that growers are more likely to undertake training in individual units rather than commit to a whole course/qualification (i.e. staggered or stepped training is more appealing). This idea has been supported by previous studies, for example

[7] Australian Vegetable Industry Development Group 2007, Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development, prepared by Dianne Fullelove.

[8] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

[9] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

the Regional Skills Development and the Agrifood Industries (2010)[10] study. However, this current study did not find this to be true - overall this method of learning was ranked six by growers as their preferred way of learning out of 13 choices, with formal training courses ranked two.

Another key message that came from both the surveys and interviews, was the importance of informal learning opportunities. Other studies have also highlighted the importance of informal learning within the agricultural sector (AgriFood Skill Australia – Business Skills Project (2009)[11]) The demand for field days, farm tours, conferences, seminars and information sessions was high among many demographic groups, but particularly preferred by older growers with lower level qualifications. An example of informal learning was the support growers (of all demographics) had for national and international study tours (either on their own or organised events). Young farmers who had participated on AUSVEG study tours were very positive about the experience and the networks that the opportunity had opened up for them.

'*travelled to NZ with young growers group and to Queensland. It was really valuable to meet other growers and learn what they're doing*'

While the findings suggest the next generation of growers will perhaps be more likely to adopt more formal learning opportunities there will continue to be strong demand for informal learning opportunities for the foreseeable future.

External consultants/advisors were ranked by growers as the number one training provider, number two method for finding out about tools and research outcomes, and receiving independent advice/support one on one was ranked three as a preferred way of learning. LOTE growers in particular value one on one support. During the desktop study, some state grower organisations expressed concern regarding the dependency that growers have on external advice (particularly where the advisors are not independent), in that this arrangement may lead to situations where growers are receiving advice that is not always in their best interests. However, one on one communication is still a preferred way for growers to learn and to receive information , and increasingly it is being provided less by the public sector (through agriculture/primary industry departments) and this gap is being filled more and more by the private sector. While, the level of training and extension services provided across Australia is highly variable (e.g. NSW DPI has field vegetable extension officers, SA have no extension provided by the Department of Primary Industries and Regions), this trend of public sector extension winding back is occurring throughout Australia. It is becoming increasingly critical for researchers to engage with the private extension sector in order to distribute findings and encourage uptake.

'*the best investment of the grower levy...is the field extension officer. They can find out grower needs and tailor directly for them*'

[10] National Quality Council 2010, Regional Skills Development and the Agrifood Industries, prepared for the National Quality Council by Lista Consulting and TVET Australia

[11] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

'R&D outcomes aren't getting to growers as well within industry extension officers. Need to be clever and innovative about how they are replaced (ie piggy back on existing projects/existing industry support staff, try on-line extension)'

The desktop study indicated that knowledge being passed on through families is still a very important component of training and in many cases there is reluctance to put family members (and other staff) through traineeships or other forms of formal training. This was to some extent supported by findings from the grower interviews and the survey. This reluctance may be, in some part, a result of negative experiences/perceptions of the training provided by the VET sector. However, encouraging younger growers to participate in training, either informal or formal, outside their own business is likely to have positive results for individual businesses and the industry as a whole:

'*I got heaps out of participating in a farmer business discussion group. Prior to that I had learnt everything from my family so it gave me new ways of thinking and approaching business*'

Benchmarking groups are a common vehicle for the delivery of business and marketing skills in other agricultural industries (e.g. beef producer benchmarking groups). However, there was almost unanimous agreement by state grower representatives that vegetable growers are reluctant to share information with each other. It was generally suggested that this reluctance was due to growers viewing each other as competitors without necessarily realising the potential benefits of greater industry collaboration. This view was confirmed by the results of the grower interviews. Many growers interviewed, stated that they would be interested in participating in discussion groups but that other growers weren't interested, were too competitive, or didn't share information openly enough to enable useful discussion.

'*growers won't work together, group tried to start and failed. Too much history and competition*'

4.4 Extension tools

The desktop study revealed that while there are limited opportunities for training in business skills, there are many tools to assist in farm financial/business management available on the internet. However, based on the results of the grower survey, the availability of farm financial/business management tools on the internet does not appear to have reduced the skills gap in this area. This is an important consideration where tools are developed as a stand-alone learning instrument – they are unlikely to have the influence on up skilling that might be expected. This may in part be explained by the fact that growers are not readily able to find these tools - the desktop study scan of tools/programs using a specified search methodology did not deliver some programs and tools that are known to have been developed. The desktop study also indicated that the provision/ease of availability of tools and information to support skills improvement is highly variable depending on state. In addition, only about one-third of growers surveyed actively sought out tools and case studies on the Internet.

There was some indication by growers who were interviewed that they find the constant flow of tools, books and factsheets overwhelming and often get someone else to find out information on their behalf (e.g. IDO, extension officer, advisor). Hence, a slightly larger proportion of growers were inclined to use tools if they were introduced to them through extension officers or at field days and workshops.

'*there is so much information that it is overwhelming and hard to find what you need*'

'*I rely on agronomists who know what my interests are to tailor information to my needs*'

The desktop study found that across the country, farmer case studies were not readily accessible on the internet except through the EnviroVeg Program on the AUSVEG website. However in the survey growers rated them as being of high value. There is potential for farmer case studies to be more widely used to communicate key learnings to growers.

4.5 Employee skills and training

The majority of the workforce in the vegetable industry are 'unskilled' seasonal or casual workers. Many of these are provided by labour hire companies, with fewer businesses directly employing their own casual/seasonal staff. The interviews highlighted that having access to a pool of unskilled labour with a good work ethic is critical to the ongoing survival of the vegetable industry:

'*90% of the workforce is unskilled and this is what is needed*'

'*unskilled staff are important to business functioning*'

The majority of these unskilled workers come from a variety of backgrounds, typically Cambodian, Indian, Albanian, Korean, Taiwanese and Chinese, and a large proportion speak and read English poorly (and sometimes are not literate in their own language). It was evident from the interviews that there is some concern about the ability to communicate clearly with these workers, particularly from an occupational health and safety perspective. Many businesses overcome or manage this issue by employing permanent staff of the same language and ethnicity to manage the LOTE workers. Other issues raised with regard to the employment of LOTE workers are the short-term nature of their visas and the lack of recognition of formal qualifications from other countries (e.g. forklift tickets).

Growers have indicated that the skill levels required for much of the work in the industry is fairly low and therefore formal training is not necessarily a priority. They have also pointed out that the transient nature of their workforce is a deterrent for investment in training of workers. Generally the only training offered is that which is essential for OH&S, market or regulatory requirements. For many growers, training employees is seen as a cost rather than an investment. However, this attitude to employee training does not extend to all employees in the business, and many growers running medium and large businesses do recognise the value in training, to an appropriate level, all workers:

'*training employees means they are more likely to understand why they should do something a certain way, and then they are more likely to do it the right way*'

Nevertheless, qualifications (licence/ticket to operate and formal VET qualifications) are of secondary importance to growers when selecting people to employ - good work ethic, willingness to learn and previous practical on-farm experience are the most important attributes desired in new employees.

The majority of training delivered to employees is either informal or structured on the job training, and reasons for training are mainly focussed around business efficiency, profitability and quality (in addition to legal requirements). The importance of training on the bottom line of businesses is demonstrated by the fact that small and medium sized businesses are more likely to offer training to staff if subsidies are available, while growers with large sized businesses are more likely to do so if there are more on the job training opportunities.

In SA and Queensland a Farm Card model is in the early phase of being rolled out – this is a broad industry induction course (equivalent to the induction card used for building industry), which may be valuable for growers employing casual and seasonal labour. The Lockyer Valley Alliance had a passport system developed about 10 years ago, however the state government funding for this was withdrawn in the first six months of the program which caused it to fail. This system used a 'passport' which employees completed with information such as the farm operations they had worked in (been informally trained in) and employer name and contact details. This enabled future employers to be more confident of employee skills. Training of employers in Certificate III Workplace Assessment & Training was another component of the passport system, which aimed to improve employer skills in training and also to enable the passport system to be a more formally recognised qualification. This system was well received by growers, and there may be a place for it in the industry in the future.

Very few apprentices are employed in the vegetable industry either because young people are not interested, or growers did not see enough benefit in the arrangement. It may also be related to the poor perception of the VET sector amongst growers. Based on responses of growers interviewed there is unlikely to be an increase in uptake of apprentices or trainees, and it may be that this kind of training system does not fit well with the vegetable industry.

4.6 Vocational education and training

The desktop study indicated that production horticulture courses offered through the VET system are grouped with amenity horticulture in most states, and state grower representatives noted that this more generic course offering does not meet the needs of the vegetable industry. The grower survey found that this was indeed the number one issue identified with VET training. Other key criticisms were that courses weren't practical enough, and trainers weren't experienced enough or industry based. Finally, and critically, courses offered are not challenging participants – they do not consider that they learn very much.

'*not challenging enough, the bar is too low*'

The requirement and expense of renewing essential qualifications (e.g. Chemcert, forklift licence) when the standard of the original course was so low was also raised as an issue in interviews.

'trainers talk down to and at students. Content of courses needs to be aimed higher and be more practical'

'farmers know more than the trainer'

Some of the state grower organisations are registered training organisations (e.g. Growcom, Grow SA), while others are not. Those who are not often provide a liaison/coordination service to arrange workshops for their members on relevant topics (often in conjunction with state agriculture/primary industry departments). Provision of training services by or through organisations who understand the vegetable industry is likely to become increasingly important with the VET sector (particularly the TAFE system) not meeting industry needs.

5 Technology Transfer

The survey was promoted via articles in the Vegetables Australia magazine (refer to Appendix 3. Copy of media articles). As this project is an industry scoping study, uptake to the industry will be facilitated by AUSVEG through the relevant investment processes including the Industry Advisory Committee, appropriate sub-committees, and HAL.

6 Recommendations

6.1 Key training needs identified from the survey

The eight training needs identified here are synthesised from a combination of the quantitative data obtained in the AUSVEG grower survey and the qualitative information obtained through interviews. The recommendations for targeting are based on the preferences identified in the data as they relate to age, qualifications, gender, preferred ways of learning and business size. They are also related to information obtained during the desktop study.

The eight training needs are listed in order of their likely impact on the vegetable sector, measured as reach across the industry and demand within the industry (refer to Section 2.2.3 for more detail on how impact was assessed):

1. Leadership, management and communication skills
2. Occupational Health and Safety (OH&S)
3. Business and financial management
4. Information Technology (IT)
5. Marketing and promotion
6. Regionally targeted training
7. Investment in digital technologies
8. Productivity

6.1.1 Leadership, management and communication skills

Leadership, management and communication skills within the vegetable industry stood out in the interviews as a specific issue (outlined in more detail on page 41). It arose frequently in relation to management and supervision of workers, by middle management or growers themselves. In the case of LOTE workers, growers reported using language speakers as team leaders to effect better communication with the workforce. However, these team leaders, while having necessary English and other language skills had some difficulty with leadership and labour management skills.

For managers and supervisors who do not have the skills required for effective leadership and management, there are impacts on the efficiency and profitability of the business. This need has been particularly identified for medium to large sized businesses. While there are some high level leadership programs available (e.g. Australian Rural Leaders Program, Growing Leaders, Leaders with a Life), programs for middle managers working in the vegetable industry appear to be lacking. There are specific needs unique to the industry including the nature of the work and the demographic of the workforce that must be addressed in any training program designed to up skill middle managers

in leadership, communication and management. The training must be practically oriented and where possible hands on. Such programs must be suitable for individuals who have English as a second language who are supervising workers with minimal or no English language skills, and must be clearly linked with improved economic and productivity outcomes.

Providing professional leadership/communication skills for managers and supervisors is not a local issue and should be addressed nationally at an industry level, although delivery may be best focussed using state-based providers. The National Vegetable Levy could be invested in developing a suitable training program, in collaboration with growers and potential training providers. Ideally courses would be delivered locally for groups of growers/vegetable industry staff, and would be broken up into a few short sessions (rather than one long session) with follow up short courses available 6-12 months after the initial training.

6.1.2 Occupational Health and Safety (OH&S)

Occupational Health and Safety (OH&S) was ranked as the most significant skills weakness in the survey. While it was well down the list of skill development priorities, it was raised prominently as an issue that should be addressed through the use of the National Vegetable Levy. Growers were very conscious of their responsibility for workplace safety and among other certification and compliance courses, OH&S courses were well attended. Nevertheless, in the qualitative responses there was a strong sense that growers felt vulnerable in this area, reflected in the frequent mentions of this issue in their interview responses.

The key areas that growers have identified that they require support and training in are:

1. An OH&S manual covering all aspects of OH&S specific for the vegetable industry (and different sectors therein, including both farming and packaging operations). This should be focused on the responsibilities of growers and how they can structure their operations (both physically and in the systems used) to meet their OH&S obligations.

2. Resources for policy/procedure development (e.g. example templates for reporting, documentation, induction etc. as components of a manual proposed in 1, above).

3. Ongoing technical industry support in the area of OH&S to provide support for growers to implement changes. This could involve dedicated vegetable industry OH&S officers, possibly hosted within state industry bodies, to provide one on one support. These officers potentially could also coordinate other industry OH&S needs (i.e. points 1, 2 and 4).

4. Industry relevant training for workers in their OH&S obligations and safe operating procedures. This issue is made more complex due to the number of operations with LOTE workers who have very poor English language (speaking and reading) skills. This could include development of resources such as DVDs demonstrating safe operating procedures of standard tasks on-farm (e.g. tractor, forklift, PTOs, etc), induction resources in LOTE, etc. On-farm, short, practical courses were highlighted as being the preferred mechanism for delivery to employees. Another option for ensuring workers in the vegetable industry have appropriate skills to safely work could be to implement a system similar to that used in the

construction industry – the White Card safety induction system. The Hort Card system (delivered by OTrain) is an example of such a system designed for the horticultural industry in Queensland. However ideally any induction system should have national support, and input into its design by industry representative bodies across all states. This would enable it to have the same rigour of the construction industry White Card – ideally it should be mandatory in all states.

The broad nature of the target group of growers who require OH&S support and up skilling means that delivery of training needs to accommodate a variety of learning preferences. However, information imparted through seminars and other non-formal courses appear to be more popular among growers generally. Sole reliance on web-based information for this training need is not recommended. Providing OH&S training and support for vegetable growers is not a local issue and should be addressed nationally at an industry level. However, there may be differences in state laws that will require input/support from state vegetable industry bodies in the delivery of any program (e.g. Victoria).

6.1.3 Business and financial management

'*Farmers aren't just farmers anymore they are business managers*'

Business and financial management was ranked by respondents as the second priority for skill improvement. In the interviews many older growers indicated that vegetable production was a very different industry to which they had begun work in, and that good business management skills are now essential for young growers. The desktop study also identified improved business management and financial skills for growers as critical for the future of the industry (outlined in more detail on page 39).

Based on the analysis, the focus of business/financial management should be targeted at growers under 35 in medium-sized businesses (6-20 permanent employees) with low-level qualifications. Agrifood Skills Australia's best practice delivery model for business management includes the following 6 key areas which are required to up skill managers/owners of small/medium businesses to maximise business potential:

- Financial management
- Business management / business planning
- Marketing
- Managing staff
- Business operations
- Legal

The kind of training that would most effectively up skill growers in the area of business and financial management must be tailored to the vegetable industry. For example, using farm business case studies and templates will be an important tool for engaging growers in the training.

Formal courses delivered either face to face or online or a combination of both may also be appropriate methods of delivery for more formal training in business/financial management, given the learning preferences of the main target cohort (younger, less qualified growers). Benchmarking groups, while not appealing to many growers in the vegetable industry (see pages 43 and 61), have been very effective at up skilling producers in other agricultural industries in the area of business and financial management, and appear to be an especially valuable informal learning mechanism for younger growers. Development of an industry mentoring program for young growers may be another method of improving the business/financial management skills of young growers (see page 61 for more detail on the mentoring program and benchmarking groups).

Improving business management skills for vegetable growers (and young growers in particular) is not a local issue and should be addressed nationally at an industry level, although delivery may be best focussed using state providers.

6.1.4 Information Technology (IT)

Information Technology (IT) training was ranked as the first priority area for skill improvement in the survey (refer to page 40 for more detailed information). There are many aspects to such a broad training priority, including use of computers/internet and role of technology in improving business efficiencies. However, for many growers there was an awareness that in order to take advantage of new and emerging opportunities in their industry, they would need to become more skilled in this area. Analysis of the data by age group reveals that those respondents over 50 were more likely to identify IT as a skill weakness. Younger growers, perhaps unsurprisingly, saw IT as a strength.

Based on the analysis, the focus of IT training should be for males over the age of 50, who hold low-level qualifications. In terms of how to target training to this group, it will be important to develop promotional materials that reflect the limited understanding this group may have about the potential of IT to solve specific problems and address their learning needs. It will also be important to strongly link up skilling in IT with improvements in business productivity so that IT skills are not seen as an end in itself, but as a means to generating increased productivity and profitability. The language used needs to be simple and point to the immediate benefits of the skills they will gain from a training session.

Given the learning preferences of the key target cohort, the type of training provided should be informal, not reliant on IT resources and skills, and delivered by trainers with an understanding of the learning needs of this demographic. Content should be directly relevant and aligned to the needs of vegetable growers (e.g. demonstration on some of the IT tools that vegetable growers use, useful websites and how to locate relevant information on them).

Providing information technology up skilling for vegetable growers is a national issue for the vegetable industry as a whole. However, it is likely that state-based trainers could fulfil this need, and the main role of AUSVEG would be to inform growers of potential training opportunities and to liaise with state-based training providers on a format which is likely to be most suitable for vegetable growers in their particular area. Vegetable industry support bodies could play a role in developing course promotional materials related to specific topics, which explain to growers what the course is about, why it is relevant to them and what they will learn (in plain English). For example, training on

finding and accessing information on the AUSVEG website, and other relevant industry websites, potential APP based tools relevant to their operation or industry sector; training in use of MYOB or other financial management programs, etc.

6.1.5 Marketing and promotion

Marketing ranked as the second weakest skill among survey respondents and it ranked third as an area for intended skill improvement. It was also highlighted as an issue by growers who were interviewed (refer to page 41 for more detailed information). There are two main issues related to marketing. One relates to marketing by individual farm businesses (identified via the survey responses) and the other to industry promotion more broadly (identified as an issue in expenditure of the National Vegetable Levy to best benefit industry).

For individual businesses, the range of marketing skills needed includes supply chain management, business development, promotion, keeping pace with national and international trends, as well as consumer expectations. The desire amongst growers for up skilling in the area of marketing is likely to be driven by changes occurring within the industry supply chain – for example many growers are now dealing direct with retailers rather than via wholesalers.

There is potential overlap with training for marketing and for business/financial management, however marketing can be treated as a discrete subject/unit within business management broadly or can be taught as a standalone subject. The kind of training growers are looking for in this area goes beyond what is currently on offer. Based on the evidence from interviews, it appears that most growers who have participated in training for marketing have experienced courses which are tailored more towards the manufacturing sector or retail marketing, and these have not met their needs. One of the key lessons from the grower survey and interviews is that growers are looking for practical, relevant and industry specific training—in the area of marketing this kind of training appears to be difficult to find.

The data suggests that the issue of marketing at the farm level is mainly one for growers in medium sized businesses with up to 20 employees. Although the sample size of LOTE growers in the survey was small, there are indications that an improved understanding of supply chains and marketing would be of particular benefit to this cohort in growing their businesses. The approaches required to improve skills in marketing will be varied and likely dependent on particular industry sectors (for example the marketing needs of a business that grows and packages fresh produce will be quite different to those of a business that grows for the processing market).

The National Vegetable Levy could be invested in developing a suitable training program for growers with specific components tailored to different sectors of the vegetable industry. Supporting grower tours not just to farms, but including other facets of the supply chain (e.g. processing, distribution, retail and promotion) may be another way in which investment of the Vegetable Levy can assist in up skilling growers in the area of marketing (in addition to or conjunction with the use of industry champions or mentors – see section 6.2.5).

The interview results highlighted the importance of industry promotion/development as a significant issue in relation to the use of the National Vegetable Levy. Feedback provided by growers indicated

that good, effective industry promotion was critical for two main reasons; to encourage support for the industry from consumers (related to industry profitability) and to encourage young people to consider a career in the vegetable industry. The kind of marketing needed to achieve these two objectives will be different. There were some good examples of marketing to encourage participation in the industry in Queensland (Bundaberg Fruit and Vegetable Growers), however based on the response of those interviewed such programs need to be more widespread and to start in early high school (and to target the early high school demographic). In addition, many growers noted that until the industry is more profitable that young people will not be attracted to careers in it. AUSVEG already undertakes industry promotion, to a certain degree, as a by-product of its representation activities on behalf of the industry, but the grower responses indicated that they would like to see this ramped up, as industry profitability is a critical issue for the vegetable industry and active industry promotion may assist in addressing this.

6.1.6 Regionally targeted training

A clear message coming from the interviews was the need for training to be site specific and relevant (refer to pages 42 and 43). Growers are looking for training that can be applied directly to their context. By state, there was considerable variation in the skill improvement priorities of growers. For example, in New South Wales, the main priority was pest and disease management, in Victoria it was soil and nutrient management, in Western Australia and Tasmania it was Information Technology, while in Queensland and South Australia it was business and financial management. This is likely to be a function of the predominant skill sets available within the extension services in each state. The qualitative data highlights that targeted professional development is a priority for many growers from all states, wanting to develop management and leadership skills across a range of requirements for their business.

The desktop study revealed that delivery of training and extension programs to vegetable growers around the country is variable, although in the majority of cases it is either delivered by or co-ordinated by the state vegetable industry groups. In some states there appear to be strong partnerships between grower groups and state government primary industry/agriculture departments (e.g. Western Australia), in others the grower groups bring in appropriate expertise as required (e.g. South Australia). In other states delivery of vegetable industry training is more ad hoc, with little, if any, centralised coordination (e.g. Tasmania).

The data presented through the survey provides opportunities for AUSVEG members or industry bodies from each state to assess how they can best implement the training areas that are important to their industry sectors. It would seem reasonable at a state level, wherever practical, to negotiate with particular service providers who can deliver targeted courses where they are needed, rather than adopting a national approach (except for those cases noted above). Using these existing networks will improve efficiencies in delivery. However, given the variation in industry support present within each state, different strategies are required across states in implementing the training programs which have been recommended, to achieve good grower uptake. It will be important to work closely with individual states to develop state-specific and appropriate strategies. An alternative is to utilise the state based skill sets available in some states to either train the trainers or role out specific courses in other states.

6.1.7 Investment in digital technologies

Digital technologies are quickly being adopted by growers for a variety of purposes—learning among them. While it is evident from the data that older growers with lower level qualifications are not adopting technology at the same rate as younger growers, the trend towards uptake of digital technologies and associated resources is only going to gather pace in the next decade. The survey and interviews both confirm the variety of ways that a significant proportion of those surveyed use technologies for learning: online courses, online tools, 'webinars', smartphones, and also to improve the efficiencies of their business operation (e.g. automated irrigated, GPS technology, etc) (refer to page 40 for more information).

There is also an emerging interest in the use of social media (noted in the interviews particularly) that could facilitate communication and networking among those with particular interests. Social media was also suggested as a possible marketing tool by some younger growers (for both individual businesses and the industry as a whole). Innovative application of technologies will inevitably extend to the development of industry specific mobile phone Apps, online events, use of social media, online courses, web-based interactive tools and calculators along with an extension of downloadable materials.

AUSVEG, and the state vegetable industry bodies, already play a role in promoting the use of web-based resources and tools through their websites. In the short term, the focus of further investments in digital technology will be on younger (aged up to 35), more qualified (diploma and above) growers who are reasonably well-skilled in the use of digital technologies. In the medium to longer term it is inevitable that there will be a demand for more digital resources across a much broader cross section of the grower base. However, this will depend on growers overall improving their skills in this area (refer to section52 6.1.4), or retirement and exit of older growers from the industry. It is important that increasing use of technology for extension, training and networking, does not isolate those sectors of the industry who are not proficient in the use of them (i.e. that these are not used in place of more 'traditional' training/extension methods).

One approach for the progressive investment of technologies could be to use those who are already using these tools to lead the way in their development and subsequent promotion. Other developments may require specific expertise (such as the development of Smartphone Applications (APPs). To progress this agenda, it will be important to draw on the ideas and thinking of technological 'early adopters' within the industry. For example, effective use of social media could be a component of industry marketing (especially relevant to the 'high school' demographic), or a promotional tool for individual businesses (section 6.1.5). It could also be used to run "remote" discussion/benchmarking groups (section 6.2.5). APPs are already being developed by other industry peak bodies in addition to being available through other sources for production, QA compliance, etc, and this is a role that AUSVEG or an appropriate service provider could play for the vegetable industry. The GRDC website, for example, has an APP Store. Levy funded programs could be created to coordinate webinars for presentation of topics which may be of relevance to growers in a range of different growing regions, including findings from large R&D projects.

6.1.8 Productivity

An important learning from the survey is that the primary reason growers undertake training is to increase profitability. The main reason training is provided to staff is to improve the efficiency of the business. In the interviews, there are strong indications to suggest that many growers are looking for targeted professional development to support their need for improved business management and that in general terms, business productivity and efficiency is a priority. They also want training that is site specific (and this is related to productivity, as it means less time out of the business to participate in training).

Those who were most motivated to improve business efficiency were younger growers up to the age of 35 and those with post-graduate qualifications. However, in other respects (based on business size, gender, LOTE, years of experience) the issue of productivity and efficiency is universal. The suggested target group could well be attracted to training programs that focus on innovation (for example in the use of digital technologies, refer to section 6.1.7). Of course, growers of all ages are interested in improving efficiency, productivity and profitability. Therefore, while younger more educated growers should be encouraged to develop their businesses, the issues of competitiveness and efficiency are industry-wide issues that affect all growers.

While recognising that it would be nearly impossible to develop courses that are focused on productivity, what is very important for both training and information dissemination about training, is to demonstrate the link between courses and seminars about what may be perceived as relatively unproductive topics (e.g. QA and compliance, WH&S/OH&S, R&D findings, business and financial management) and farm productivity and production efficiency. Enabling growers to make a clear connection between training and productivity (for either themselves or their staff) will provide considerable motivation to participate in training. It should also be noted that while business and financial management skills are only one factor in improving efficiency and profitability, they are foundational activities - hence supporting training in improved business/financial management will be critical for productivity improvements (refer to section 6.1.3).

6.2 Implications and considerations arising from training needs

There are a number of implications and considerations that arise from the key training needs identified in section 6.1. Some of these are relevant to a number of training needs. In other cases, there are particular implications for specific sectors of the vegetable industry. The purpose of this section is to suggest methods of delivery to address the training needs. The key implications and considerations identified during this study are:

1. Targeted training
2. Informal learning opportunities
3. LOTE workers
4. Grower networks and information sharing
5. External advisors/consultants
6. Tools and extension materials
7. Subsidies and grants
8. Developing and nurturing the skill set of younger growers
9. Formal VET training sector

Figure 23 presents diagrammatically the interaction between the key training needs and the key considerations/implications identified. The implications which are relevant to progressing each of the key training needs are highlighted where they intersect.

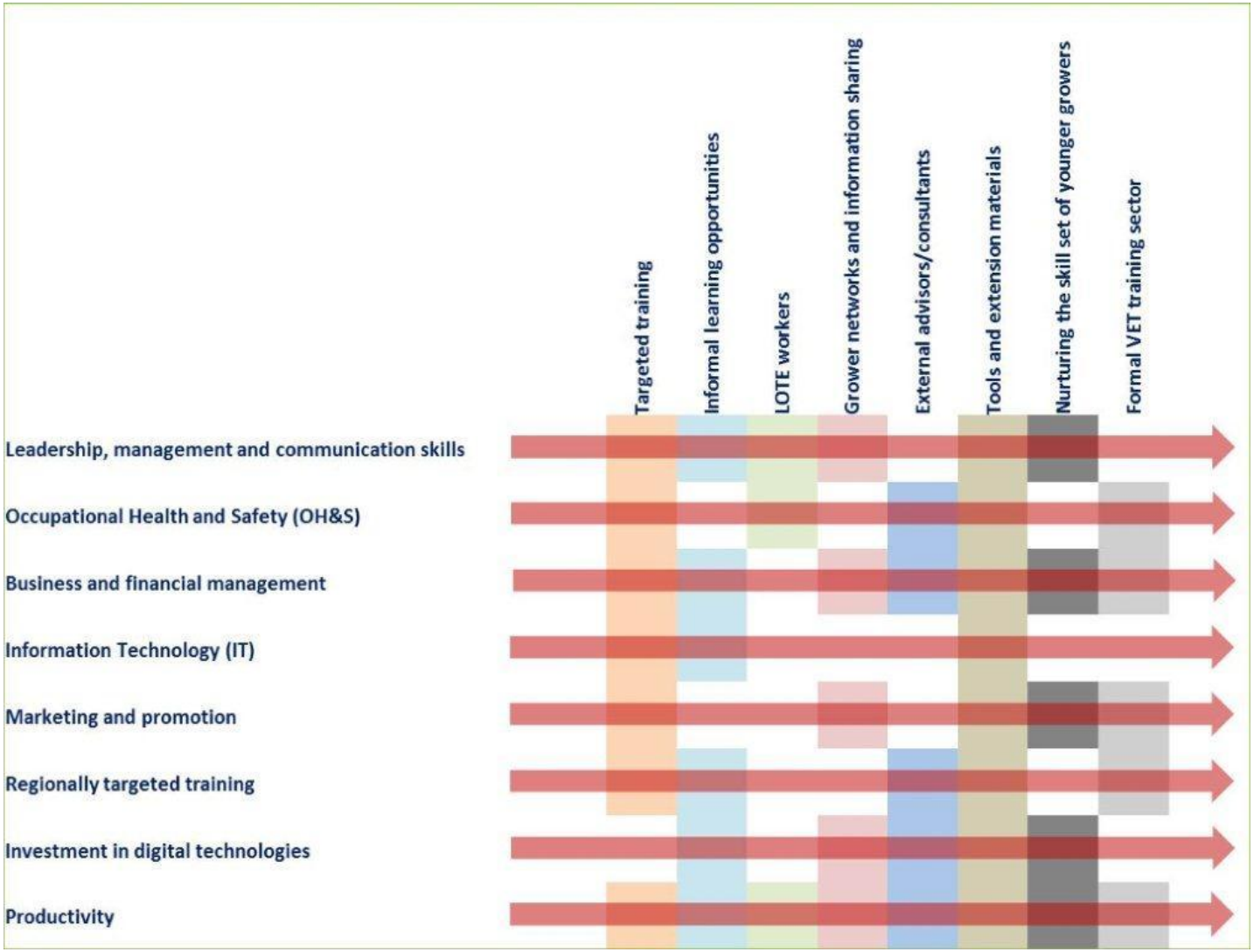


Figure 23: Interaction between key training needs and the implications/considerations identified

6.2.1 Targeted training

One of the important considerations to emerge from the findings is the desire among growers for targeted training as opposed to generic training, particularly as it relates to skilling up employees—and even more so those who are casual or seasonal. In many contexts skill development needs to be focused on what is needed to ensure that employees are safe and productive. While a significant proportion of growers already have VET, diploma, bachelor or post-graduate qualifications, which include generic skills, training in this form is not what is required for skill development of workers—at least from the perspective of those who were interviewed and surveyed. This is reflected in the low number of apprentices and trainees that farm businesses are employing. The interviews highlighted a demand from growers for mobile trainers who travel to farms/farming districts and deliver training for workers on-farm.

In terms of training provided for themselves, growers remarked during interviews that they would prefer to go to smaller events that were targeted for their crop/industry sector, so that all the information covered is relevant to them (i.e. they don't attend a day session, of which only 20% was useful for them). This is something for trainers to consider when formulating training events (either formal or informal), and relates directly to the training need to be productive and profitable.

Where training courses are developed/training materials produced it is critical to use the state industry bodies both in the development phase and the dissemination phase.

6.2.2 Informal learning opportunities

Another key message that came from both the surveys and interviews, was the importance of informal learning opportunities. The demand for field days, farm tours, conferences, seminars and information sessions was high among many demographic groups, but particularly preferred by older growers with lower level qualifications. An example of informal learning was the support growers had for national and international study tours (either on their own or organised events). Continuing support for these kinds of events through use of the levy is strongly recommended.

There is strong demand and interest in training and learning related to farm management (soils, nutrients, pests/disease, irrigation), and the survey results indicate that this kind of information is best delivered using informal training methods. This type of information primarily results from outcomes of R&D programs, and it is recommended that R&D projects have built into them funds for extension activities (while the researchers themselves may not lead extension activities, there is provision for them to be undertaken). Use of factsheets or calculators as standalone extension materials to disseminate research outcomes is not recommended (refer to section 6.2.7).

While the findings suggest the next generation of growers will perhaps be more likely to adopt more formal learning opportunities there will continue to be strong demand for informal learning opportunities in the future. Informal learning opportunities therefore should continue to be supported and encouraged. An example of how this may be achieved might be through the use of a grants program for delivery of informal extension activities (key amongst the eligibility criteria would be that any extension program delivers on priorities in industry strategic plans). This would also be a

way in which there could be collaboration with appropriate state bodies or service providers to deliver targeted regional training (refer to section 6.1.6).

6.2.3 Supporting LOTE workers

Many vegetable growers throughout the country rely heavily on LOTE workers in both casual and permanent positions. These come from a variety of backgrounds and many speak and read English poorly (and sometimes are not literate in their own language). There are some concerns about the ability to communicate clearly with these workers. The challenge is that the group of LOTE workers is very diverse and transient. The need for basic multi-language resources (including DVDs of basic work practices and OH&S tools/forms to use for induction, signs and information posters) that cover the main languages spoken, is evident (refer to section 6.1.2), and is a recommendation from this study.

Recognition of prior qualifications of LOTE workers (such as forklift ticket, often obtained from overseas) would assist growers who employ these workers for limited periods to fully utilise their skills. Another issue with regard to employing LOTE workers was the short term nature of visas – high staff turnover could be reduced by extending the length of visas. These are all issues that could be addressed at an industry-wide level, through AUSVEG lobbying activities.

6.2.4 Supporting LOTE growers

While only 17% of responses to the survey were from LOTE growers, there are some areas in which they clearly require additional/different support to non-LOTE growers. Some of these areas have already been covered (e.g. preference for one on one support (section 6.2.6), need for up skilling in marketing/supply chain management (section 6.1.5).

Other areas of concern regarding LOTE growers are their ability to read and understand chemical labels and their management of pests and diseases (e.g. weeds outside paddock boundaries). The survey and interviews indicated widely varying use of the internet/computers amongst LOTE growers – it is an area where some require up skilling. Many LOTE growers are not effectively engaged with industry through peak industry bodies (i.e. they don't appear to read publications distributed either by hard copy or email).

Some state industry bodies currently, or have in the past, employed extension officers of the same ethnicity as LOTE growers, where there is a large group of LOTE growers of the same country of origin. This has proven very effective in engaging with LOTE growers and improving their farm management skills, and is something that could potentially be supported through use of the National Vegetable Levy (although there are potential complexities where a diversity of cultural groups are present in the one area). LOTE resources regarding chemical use, handling etc could also be developed and distributed via chemical retailers. Language specific Chem Cert courses could also be developed.

6.2.5 Grower networks and information sharing

An interesting observation that emerged from the interviews (and the desktop study) relates to the issue of information sharing among growers (refer to page 43). While many were supportive of the idea of sharing information, and building networks to share information, there was a strong view that the competitive nature of the industry meant that growers were inhibited from doing so. This seems at odds with the way that growers prefer to learn—often through informal sessions such as field days and workshops. Vegetable growers recognise the benefits of sharing information within the industry, and many regularly travel overseas to learn from seed/machinery supplier and growers in other countries. Producers from other industries (e.g. beef, dairy, wool) regularly utilise and benefit from benchmarking and producer discussion groups.

However, the findings from this study suggest that there are challenges in maximising the opportunities for learning by this means within the vegetable industry. A lack of cooperation between growers may be restricting industry development - this is potentially a major challenge for the industry. It is recommended that there be collaboration with state industry bodies, private state extension providers and other relevant organisations to support the establishment of grower discussion groups, particularly focussing on engaging younger growers to participate in these groups. The groups could be built around supporting growers who are participating in a course on business management or marketing, for example, or they could be more focussed on aspects of technical farm management (e.g. brassica growers discussion group). An alternative design for benchmarking groups could be based on the assumption that growers from other states may be less of a threat than those in the same area – in which case a system to enable national on-line benchmarking/discussion group forums may be worthwhile trialling. A combination of synchronous and asynchronous online meeting spaces could be used - including less formal approaches such as Facebook groups as well as moderated forums, and facilitated discussions/webinars.

An alternative program might involve the promotion of regional or industry sector ‘champions’ who are able to offer targeted support for growers in terms of a combination of big-picture vision and more focused and facilitated farm-based workshops. These champions could also be used to facilitate farm tours, sessions at field days or other informal learning opportunities. They may be growers or advisors/consultants with significant industry experience.

There may be potential for a mentoring program for young vegetable growers to help improve communication and collaboration within the industry, in addition to ensuring that the skills possessed by older growers are retained within the industry. Working nationally may be the best design for a mentoring program – exposing participating growers to ideas and people outside their normal sphere of influence. Such a program would be best delivered by AUSVEG or an appropriately qualified service provider at a national level, and would require the use of technology to enable participants to communicate remotely (refer to section 6.1.7) in addition to supporting some face to face meetings.

Alternatively, in addition to the ideas described above, perhaps overseas study tours could be valued-added by facilitating ongoing participation in international mentoring programs/discussion group activities post-tour. An enormous amount of experience exists overseas especially in the areas of marketing and consumers and varietal development, and the threat of competition appears less of an issue with overseas growers than with Australian growers. Overseas study tours were found to

be very popular among growers interviewed during this study. These tours ranged from informal trips organised by individual growers through to more formal organised industry study groups. Value-adding to a method of learning that is popular amongst growers will be a very effective mechanism for up skilling.

6.2.6 External advisors/consultants

External advisors and consultants are highly regarded by growers as training providers, for finding out about tools and research outcomes (refer to page 43). In particular LOTE growers clearly prefer one on one communication. Many growers not only rely on their local field/extension person not only for dealing with farm management issues that they are tasked to do, but also being able to introduce them to training tools and opportunities which will be relevant to their individual business.

This finding has two main implications for AUSVEG. In order to up skill and communicate effectively with growers the network of external advisors and consultants who work with growers is critical to engage with. There is also the option for provision of levy funding for extension staff (discussed in relation to LOTE growers in section 6.2.4), although it is recognised that this may be challenging to provide in a way that is perceived by industry sectors and regions of the country as being equitable.

Designing the AUSVEG member database so that the grower advisor/consultant network can be communicated with separately from the grower network is an important first step. Developing a separate section on the AUSVEG website, with forums (both synchronous and asynchronous), extension/training tools, etc specifically aimed at extension providers (such as agronomists and service providers/supply chain personnel), is another mechanism by which AUSVEG can better engage and communicate with this sector, in turn enabling better communication with and support for growers.

6.2.7 Tools and extension materials

Findings from this study suggest that tools, calculators and other extension materials have limited value as standalone learning resources, particularly when the major way they are disseminated is via the web (refer to section 4.4) . Part of the reason for this may be that many growers have some difficulty finding what they are looking for on the internet, while other growers tend not use the internet as an information source. In addition, some respondents reported difficulty finding what they were looking for on the AUSVEG website. Given the variable computer literacy of vegetable growers, and the fact that a majority of information is now distributed predominantly via the internet, the effective storage and availability of information on the web is an important issue for the industry. Better informing growers on how to find information on the AUSVEG website is important – this could be done not only via electronic communication (e.g. email) but also via articles in the Vegetables Australia magazine or short fact sheets (aimed at those with low computer literacy).

Another solution to the problem of easily accessible tools and information could be to create a separate tools and extension materials site that includes links to generic agricultural tools as well as providing specific information pertinent to the vegetable industry. If used in conjunction with

targeted training, this may help growers make better use of tools (and will also ensure that tools developed in one part of the country become readily available to growers in another).

Grower case studies are extension tools that are well regarded by growers, and these could be used more extensively within the industry. For example R&D outcomes could be explained via grower case studies where appropriate. Grower case studies could be used to encourage involvement in benchmarking/discussion groups by highlighting the positive experiences of participating growers.

6.2.8 Subsidies and grants

Findings from this study suggest that subsidies and grants would be a well received method of providing support to growers for training. It would clearly provide an incentive for the training of employees. The interviews indicated that the profit margins of small to medium sized businesses limited their ability to fund training for their employees, and subsidies were favoured. Subsidies would give growers the opportunity to attend courses and undertake training or to develop training materials that will be directly relevant and of benefit to their business. There are two types of programs that could meet this demand from growers, through use of the National Vegetable Levy, although it should be acknowledged that there are considerable administrative costs to running a grants program and therefore the benefits of implementing one must be carefully balanced against the benefits of implementing other actions recommended in this report.

1. A subsidy system which would operate in a similar manger to the FarmBiz/Farm Ready programs (i.e. approved growers could submit receipts for training courses for reimbursement). There would need to be clear guidelines developed, for example on the types of training eligible, amounts of funding available per business, whether the subsidy is for staff/management, etc.

2. A grants program for training (i.e. growers apply for funding for a specific purpose). This would enable growers to target funds in a way which would provide most benefit to up skilling staff in their business (for example, it might include development of OH&S manual for staff or running a training session for all staff with an outside trainer). This type of program would provide scope for growers to develop innovative ideas to assist with up skilling/training. Again, such a program would require clearly defined eligibility criteria.

6.2.9 Developing and nurturing the growing skill set of younger growers

There needs to be increasing recognition of the growing set of skills and knowledge that younger growers in all sectors bring to the industry. The survey results point to an increasing demand among younger growers to draw on formal qualifications to build their business management and leadership skills (refer to sections 6.1.1and 6.1.3).

The knowledge and innovation that comes from this younger group of growers has the potential to improve the productivity, competitiveness and sustainability of the industry into the future. In particular, their adoption of new technologies has the potential to keep the Australian vegetable industry at the cutting edge of production (refer to section 6.1.7).

Individuals who express the need to build their formal qualifications, and therefore subsequently contribute back to the industry, should be supported and encouraged. This could be achieved through industry awards for young growers in different categories (e.g. industry sectors, role in business, contribution to industry as a whole, etc). It could also be done via use of scholarships or grants for young growers to improve their skills or knowledge in a way that will provide clear benefits for the industry as a whole (this could be done through a grants program such as that outlined in section 6.2.8). Young growers are also likely to benefit from support through interactions with other growers either via discussion groups or a mentoring program, as previously discussed (section 6.2.5), in addition to opportunities to participate on young grower discussion tours.

6.2.10 Selective use of the formal VET training sector

Better targeting training has implications for the way the industry engages with the VET sector. Clearly the demand for apprenticeships and traineeships is limited, but the demand for specific vocational skills that support business productivity and ensure compliance with legislative and regulatory requirements is high. The VET sector is therefore important as a source of training for specific vocational skills such as OH&S, First Aid, certifications, licences and some specific technical skills. However, a large number of growers identified criticisms of the VET sector and these will need to be addressed for growers to willingly engage in training with the VET sector. Involving local farmers in course/unit structure and retired farmers in course delivery may assist in overcoming some of the inadequacies identified in the VET sector.

7 Acknowledgements

The authors would like to thank representatives from state vegetable industry bodies across Australia who provided their time and expertise to the project team conducting this review, and who encouraged members of their organisations to participate in the study. These people were: Mike Redmond, Peter de Lacy and Tony Zerella (Grow SA); Michelle Templin and Scott Wallace (Growcom); Nick Steel and Mel King (TFGA); Jim Turley, Sarah Houston, John Shannon, Truyen Vo (Vegetables WA); Tony Imeson, Rod Hall and Helena Whitman (VGA Victoria); Denise Kreymborg (Bowen Gumlu Growers Association); Greg Weir (Bundaberg Fruit and Vegetable Growers); Mike Titley (Applied Horticulture Research, NSW), Alison Anderson (HAL), and Murray Spicer (NSW DPI).

Finally, a very big thank you is due to the vegetable growers who completed the survey in their own time, and to those who made their time available to participate in phone/personal interviews. Their insights and contributions have been invaluable.

Appendix 1. Results from grower survey

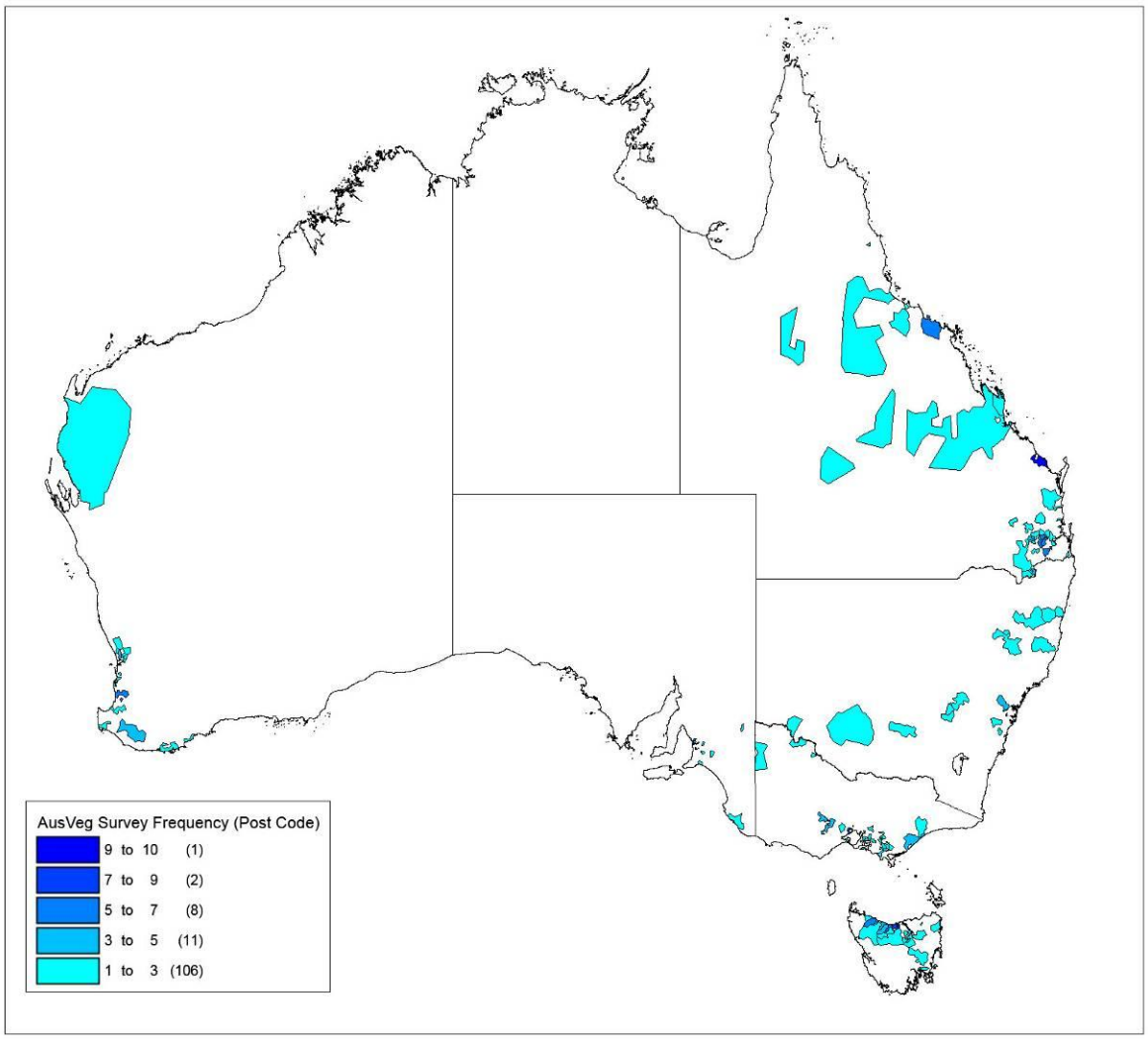


Figure 24: Q1.3 What is your postcode?

(Sample size=241; 5 growers did not state their postcode)

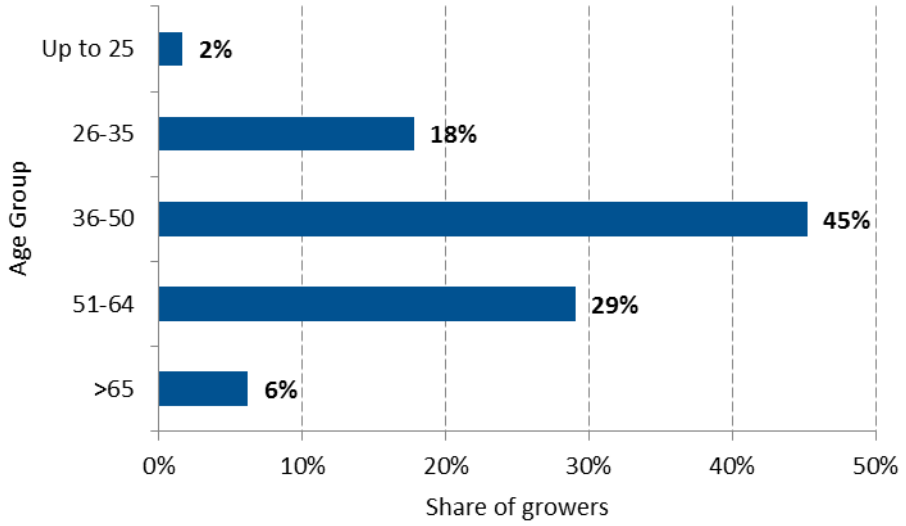


Figure 25: Q1.4 What is your age?

(Sample size =241)

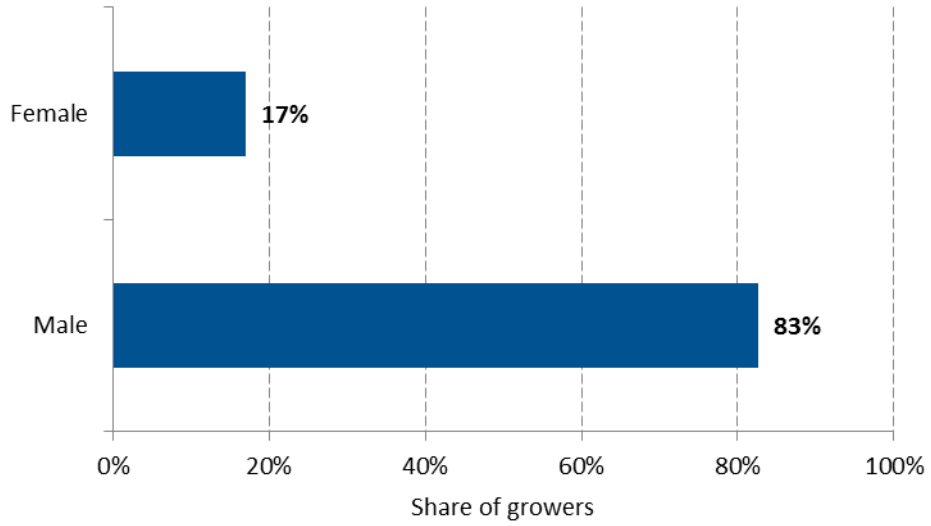


Figure 26: Q1.5 What is your gender?

(Sample size = 241; 1 grower did not state their gender)

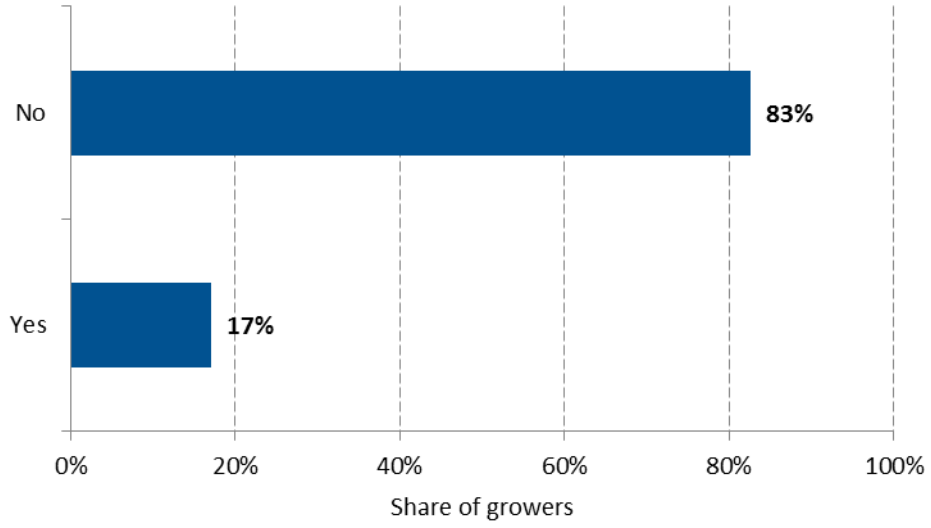


Figure 27: Q1.6 Do you speak a language other than English as your first language?

(Sample size = 241; 1 grower did not respond to this question)

Table 6: Q1.7 If you answered yes to Question 1.6, what language do you normally speak?

Language	Number of Growers
Italian	10
Vietnamese	5
German	3
Dutch	2
Serbo-Croation	2
Arabic	1
Khmer	1
Greek	1
Hungarian	1
Maltese	1
Polish	1
Sinhalese	1

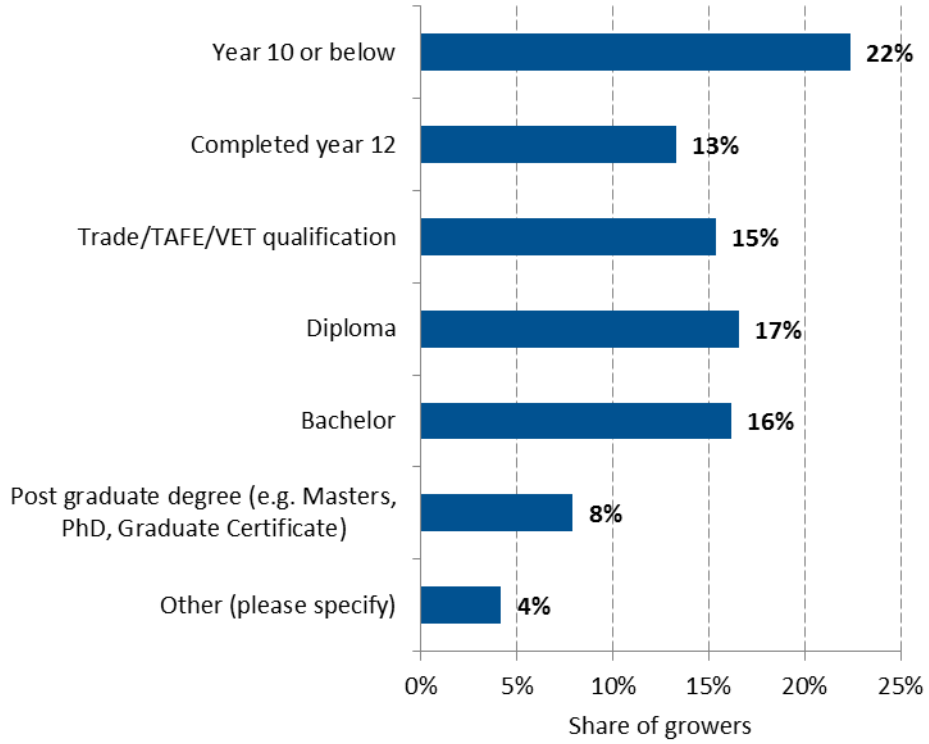


Figure 28: Q1.8 What is your highest level of education (in Australia)?

(Sample size = 241; share of growers may not add to 100% as 10 growers did not state their level of education)

Question 1.9 asked growers who has obtained qualifications outside Australia to list them. Responses to this question were varied.

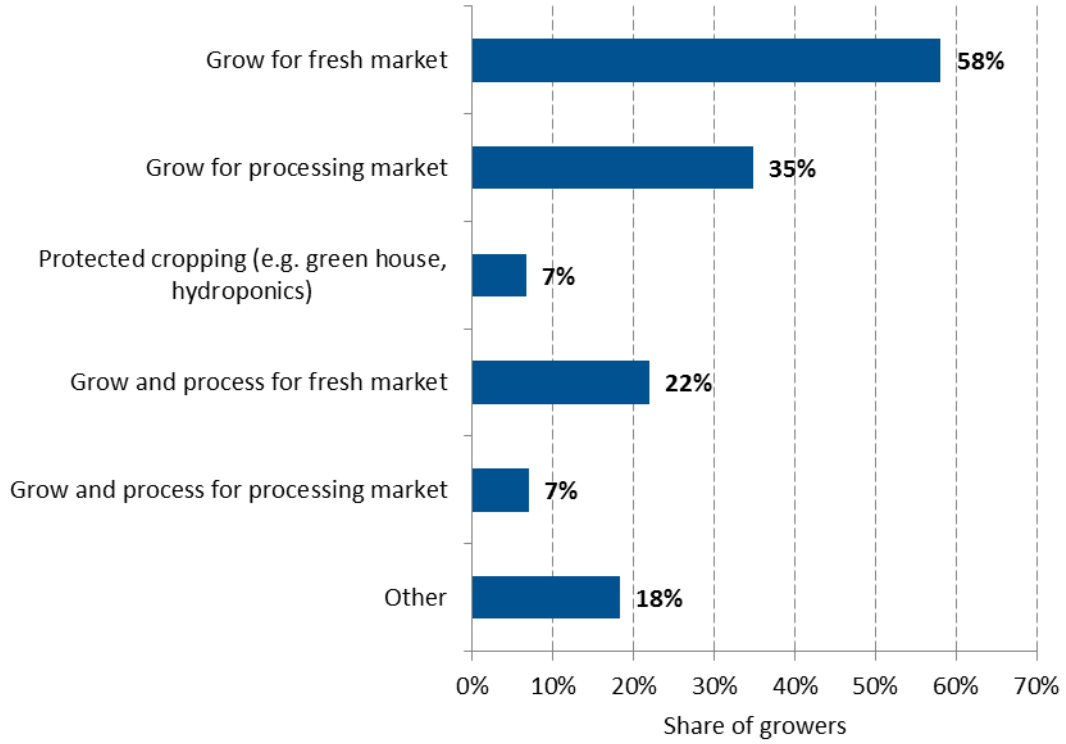


Figure 29: Q1.10 Which of the following would best describe your business? (Top ranking only)

(Sample size = 241; share of growers do not add to 100% as multiple responses permitted & 9 growers did not describe their business)

Table 7: Q1.10 Which of the following would best describe your business? (Multiple responses ranked)

		Share of Growers					
		Grow for fresh market	Grow for processing market	Protected cropping	Grow and process for fresh market	Grow and process for processing market	Other
Grow for fresh market	Share of Growers	58%					
Grow for processing market		22%	35%				
Protected cropping (e.g. green house, hydroponics)		2%	1%	7%			
Grow and process for fresh market		25%	8%	2%	22%		
Grow and process for processing market		3%	4%	2%	5%	7%	
Other		3%	2%	1%	2%	1%	18%

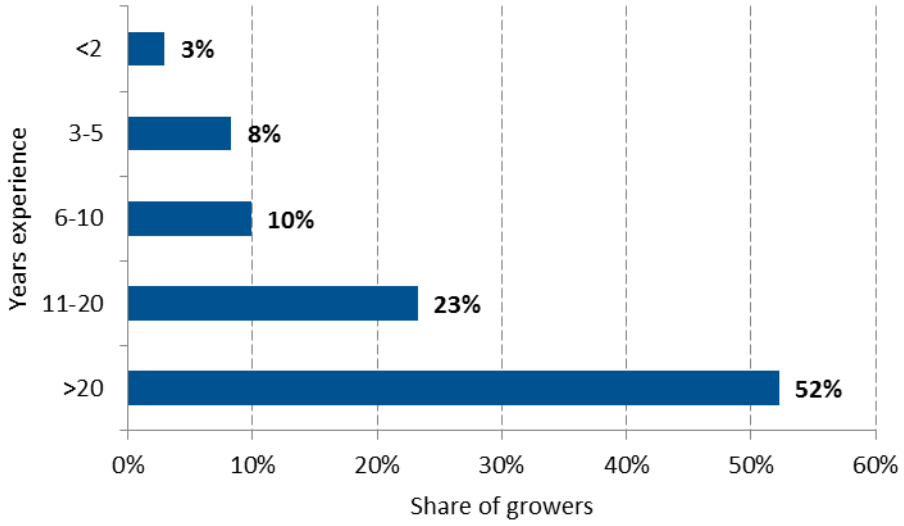


Figure 30: Q1.11 How many years experience do you have in the vegetable industry?

(Sample size = 241; share of growers may not add to 100% as 8 growers did list their years of experience in the vegetable industry)

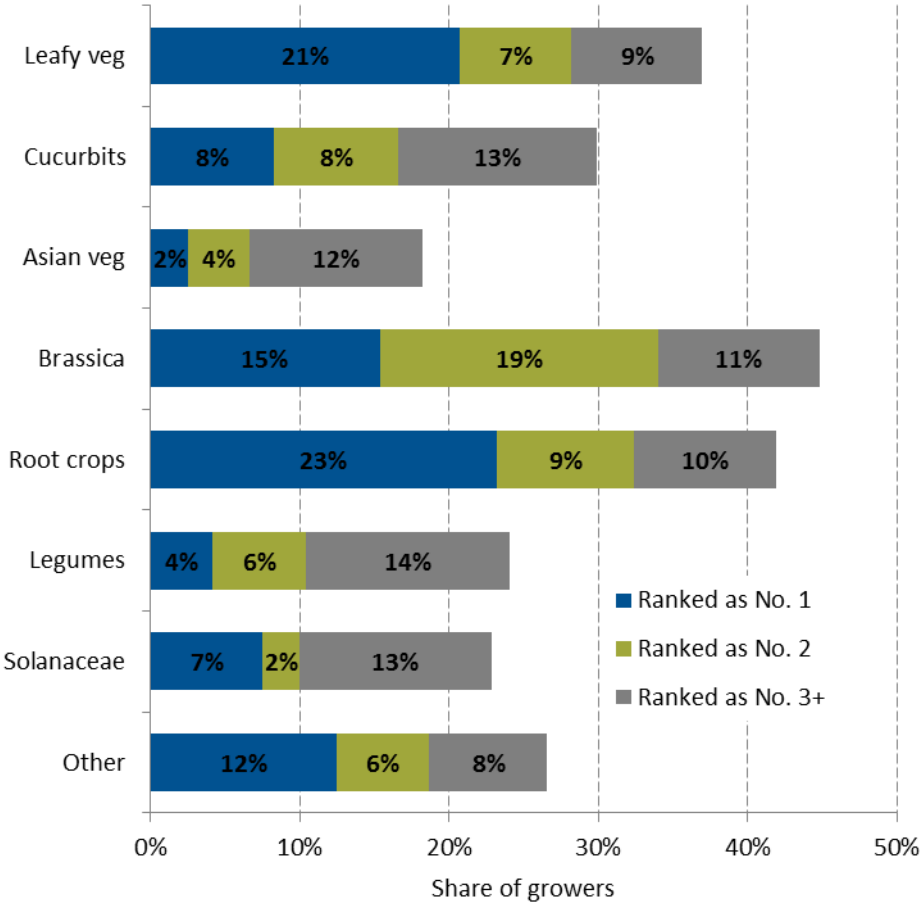


Figure 31: Q1.12 Which sector/s of the vegetable industry are you involved in?

(Sample size = 241; share of growers may not add to 100% as 13 growers did not list which sector they are involved in)

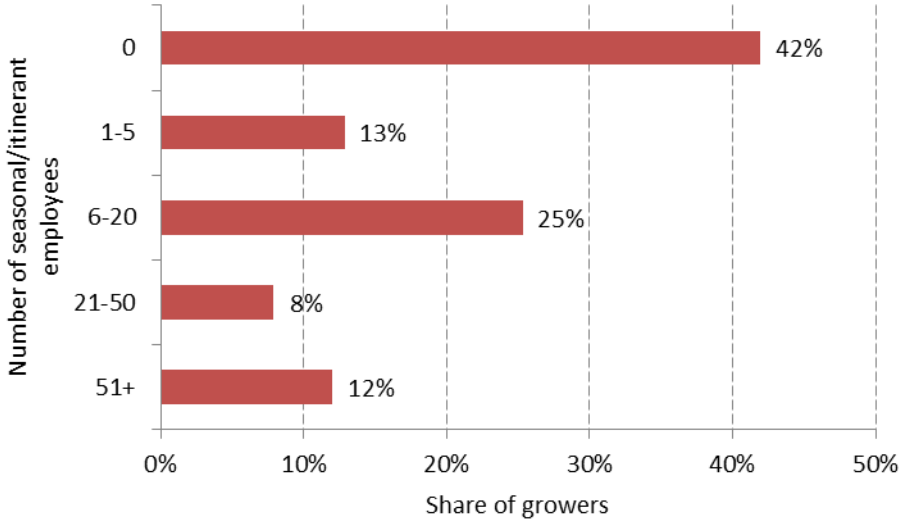


Figure 32: Q3.2 What is the maximum number of seasonal/itinerant employees that you would employ in a typical 12 month period?

(Sample size = 241; 72 growers not responding to this question were recorded as having no employees)

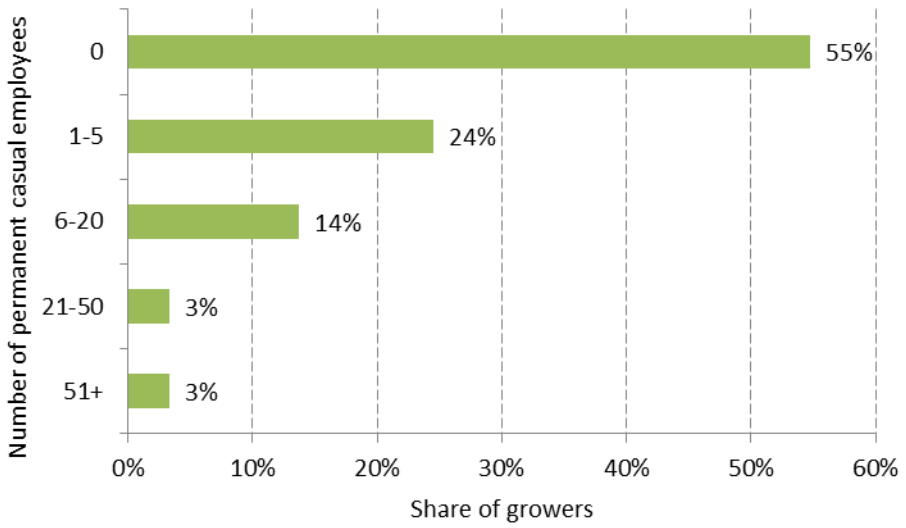


Figure 33: Q3.3 What is the maximum number of permanent casual employees that you would employ in a typical 12 month period?

(Sample size = 241; 90 growers not responding to this question were recorded as having no employees; 1 grower did not respond to this question)

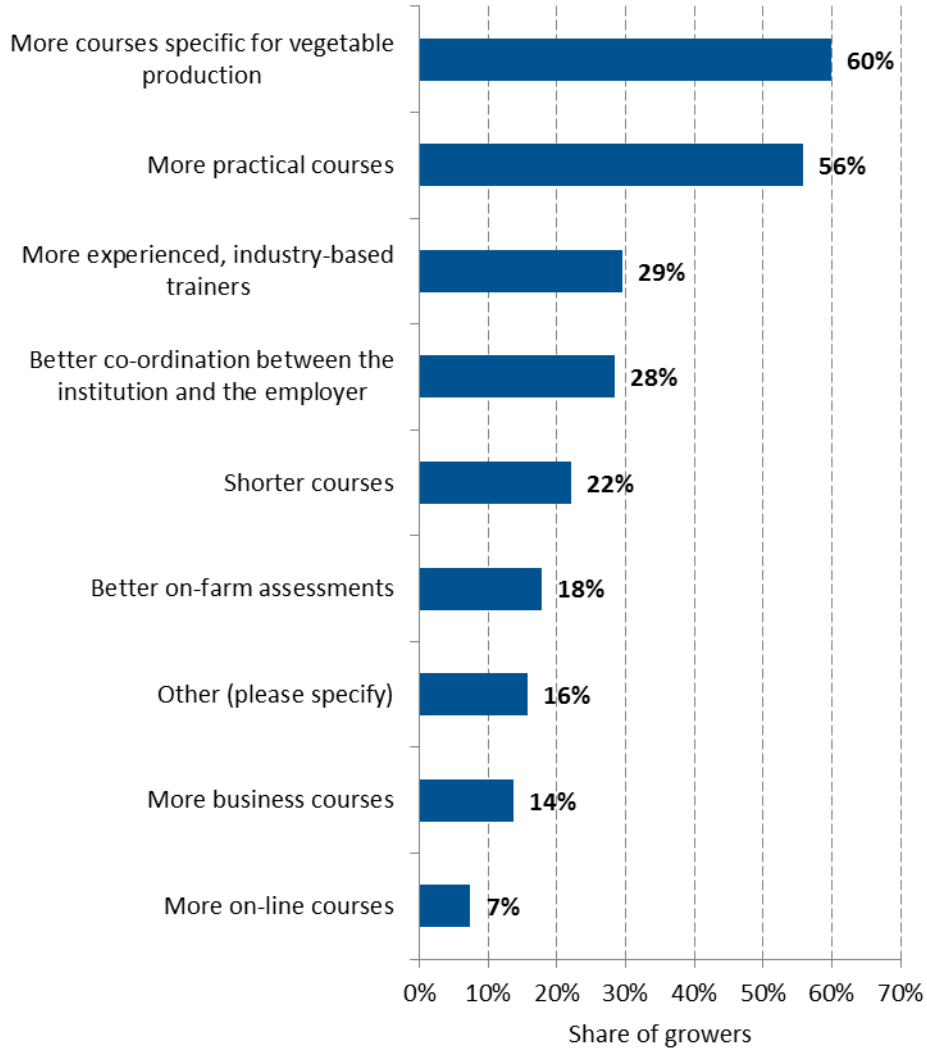


Figure 34: Q3.10 If No (to Q3.9) hat would improve the course offerings? – Top 3 responses

(Sample size = 94; share of growers may not add to 100% as multiple responses permitted and 4 growers did not record a valid response to this question)

Table 8: Summary of suggestions on question relating to the best investment for levy (results from interview and survey respondents combined)

Theme	Includes	NSW	VIC	QLD	SA	WA	TAS	Total
Business, OHS, WHS, QA	Also related to insurance, IT skills, communication, basic business management skills, compliance requirements	6	20	15	8	16	2	**67**
Non-formal learning	Tours, networking, field days, input from grower experts, think tank, sharing ideas, one to one advice, Ag Department presentations, extension officers, major annual events, discussion groups, farm walks, shed meetings, mentoring	2	8	12	1	16	3	**42**
Targeted and tailored training	Catering for diverse interests, intense formal training, innovative methods, utilised in areas where collected, filling in skills gaps, better structured around business needs, roving trainer	1	6	13	2	10	3	**35**
Farm management	Soil, nutrient, pests, machinery, organic, biological practices, chemical management, certificates, licences	3	5	10	9	6	1	**34**
Industry development	Agchem, Protective Cropping Institute, industry development officers, industry promotion and marketing. R&D	2	5	6	6	8	1	**28**
Entry level skills	For TAFE, school leavers, practical, competency based, structured training, on farm experience, recognition for current skills	2	5	7	4	6	0	**24**
Business development, marketing	International trends, professional standards, market research	5	3	7	2	3	0	**20**
Human resource management	Staff performance, leadership skills	0	7	2	4	3	0	**16**
Youth development	Encouraging young people into the industry	3	3	0	1	7	1	**15**
Tools and resources	Sharing results of R&D, magazines, fact sheets, online resources and courses	2	3	3	2	5	0	**15**
Subsidies for formal training	VET and university, scholarships and grants, trainees and apprentices, compensation	2	2	1	0	10	0	**15**
LOTE resources	Educating workers with EAL, interpretation, more resources for LOTE farmers	0	4	2	2	2	0	**10**
Green card system	for backpacker labourers and transients	0	2	4	0	4	0	**10**

Theme	Includes	NSW	VIC	QLD	SA	WA	TAS	Total
Increase farmer awareness of training	Let farmers know what is on offer	1	3	3	0	2	0	**9**
Levy not needed	Levy costs too much, minimal benefit	0	3	2	0	3	0	**8**
Unsure	Depends on individual	1	0	2	0	1	0	**4**
Stop doing surveys	Irrelevant	1	0	0	0	1	0	**2**
Financial assistance	subsidies for soil tests	1	1	0	0	0	0	**2**
Integrated association	AUSVEG and Growcom	0	0	1	0	0	0	**1**

Table 9: Attitudes to training, information transfer, group learning and travel – interviews only (n=88)

Theme	Key issues	NSW	VIC	QLD	SA	WA	TAS	Total
Site specific and relevant	On job, suited to workplace, practical, focus on induction process, relevant, linked to values and vision, areas of interest, use of on-form trials	2	14	14	7	4	3	44
Travel is important for learning	Overseas trips can be important, gain a lot from visiting other farms, willing to travel	3	13	6	9	3	4	38
Non-formal ways of learning preferred	Discussion groups, university of hard knocks, one on one visits, advice, find out through reading, consultants, field officers, role of industry bodies in disseminating information, networks, tours	6	6	9	4	9	1	35
Recruitment and labour	Finding right people more important than training	0	3	9	7	5	2	26
Targeted professional development	Leadership and management programs useful, short courses, timely information	1	6	5	4	1	5	22
Online or self-directed	Can be done in own time, flexible	0	1	7	6	2	2	18
Trust and competition	Competitive nature of industry means growers unwilling to share	1	4	2	2	6	0	15
Needs direction	Unaware of what is available, help finding what is available, guidance with information received	2	1	3	4	4	1	15
Formal qualifications	University degrees, diplomas and certificates are important	1	0	4	5	1	4	14
Business productivity	Labour management, farm efficiency,	1	4	2	4	2	1	14
Too busy	Time constraints make it difficult to attend courses	2	1	2	2	4	1	12
Not interested in up skilling	Prefers to focus on farming, doesn't need skilled labour	1	4	3	1	2	1	12
Training not available	Too far to get to training, not prepared to travel for training	1	0	6	0	3	1	11
Lifelong learning	always learning new things, self-development, continuous learning	0	2	4	0	1	1	8
Technical knowledge	Prefer to focus on technical skills	1	1	2	1	0	1	6
Legislative and compliance	Demands of customers and regulations act as motivators	0	1	3	0	2	0	6
Information overload	Too much information	0	1	1	1	1	0	4
Intergenerational	Knowledge passed on through families	0	1	0	0	2	1	4
Cost	needs to be inexpensive	0	0	2	0	0	1	3

Theme	Key issues	NSW	VIC	QLD	SA	WA	TAS	Total
Quality of trainer	Poor training delivery a concern	0	1	1	0	0	0	2
Timing of training	Needs to be in off season	0	0	1	0	1	0	2
Total responses		**22**	**64**	**86**	**57**	**53**	**30**	**311**
Total respondents		**5**	**19**	**30**	**10**	**14**	**10**	**88**

Appendix 2. Copy of grower survey

Fill out this survey for your chance to win an Apple iPad!

Vegetable Industry Grower Survey

AUSVEG

HAL
Horticulture Australia

This survey is being conducted by Macquarie Franklin on behalf of AUSVEG. It is part of a Horticulture Australia funded project, which aims to find out more about the skills and training needs within the vegetable industry across Australia. This will better inform future investment in training and skills development. The information that is produced as a result of the survey will be available as a final report downloadable from the AUSVEG website.

A hardcopy of this survey has been sent to all members on the AUSVEG database, however, it is intended only for growers to complete.

The survey can also be completed online at www.ausveg.com.au/survey or on a smart phone by scanning the following code: *(You need to have installed a QR code reader or scanner app to scan the survey. We recommend 'QR Reader'.)*

If you wish to be in the running to win an iPad please provide your name and contact details when completing the survey. Responses from the survey will not be linked to individual growers and reports from Macquarie Franklin to AUSVEG will not include information that could be used to identify individual growers.

Who can I talk to about the survey?

The contact person at AUSVEG regarding the survey is:

Andrew White
Manager Industry Development & Communications
AUSVEG
1, 431 Burke Road
Glen Iris VIC 3146
Phone: 03 9822 0388
Mobile: 0409 989 575
Email: andrew.white@ausveg.com.au
www.ausveg.com.au

The contact person at Macquarie Franklin regarding the survey is:

Leanne Sherriff
Senior Consultant
Macquarie Franklin
1/369 Westbury Rd
Prospect TAS 7250
Phone: 03 6341 3196
Mobile: 0429 329 349
Email: lsherriff@macfrank.com.au
www.macquariefranklin.com.au

If you prefer to complete the survey in hardcopy format please return it to:

AUSVEG Grower Survey
Macquarie Franklin
112 Wright St
East Devonport TAS 7310

by Sunday 14 October

This survey should take between 20-25 minutes to complete.

MACQUARIE FRANKLIN

The following questions relate to finding out some background information about you to assist us in interpreting the results.

Q1.1 What is your name? *(Optional – provide only if you wish to be in the draw for the iPad prize.)*

_____

Q1.2 What is your phone or email? *(Optional – provide only if you wish to be in the draw for the iPad prize.)*

_____

Q1.3 What is your postcode?_____

Q1.4 What is your age?

- ◯ Up to 25
- ◯ 26-35
- ◯ 36-50
- ◯ 51-64
- ◯ >65

Q1.5 What is your gender?

- ◯ Male
- ◯ Female

Q1.6 Do you speak a language other than English as your first language?

- ◯ Yes
- ◯ No

Q1.7 If you answered yes to Question 1.6, what language do you normally speak?

- ◯ Vietnamese
- ◯ Italian
- ◯ Khmer
- ◯ Lebanese
- ◯ Chinese
- ◯ Arabic
- ◯ Other *(please specify)* _____

Q1.8 What is your highest level of education (in Australia)?

- ◯ Year 10 or below
- ◯ Completed year 12
- ◯ Trade/TAFE/VET qualification
- ◯ Diploma
- ◯ Bachelor
- ◯ Post graduate degree (e.g. Masters, PhD or Graduate Certficate)
- ◯ Other *(please specify)* _____

Q1.9 If you have gained qualifications outside Australia please list them.

_____

_____

Q1.10 Which of the following would best describe your business? *(Tick as many as apply.)*

- ◯ Grow for fresh market
- ◯ Grow for processing market
- ◯ Protected cropping (e.g. green house, hydroponics)
- ◯ Grow and process for fresh market
- ◯ Grow and process for processing market
- ◯ Other *(please specify)* _____

Q 1.11 How many years experience do you have in the vegetable industry?

- ◯ <2
- ◯ 3-5
- ◯ 6-10
- ◯ 11-20
- ◯ >20

Q1.12 Which sector/s of the vegetable industry are you involved in?
Please rank in order of importance to your business (i.e. profitability), where 1 is the most important.

- ____Leafy veg
- ____Cucurbits
- ____Asian veg
- ____Brassica (e.g. cauli, cabbage, broccoli)
- ____Root crops (e.g. carrots, parsnips)
- ____Legumes (e.g. peas and beans)
- ____Solanaceae (e.g. capsicum and chillies)
- ____Other *(please specify)*_____

The following questions ask about your skills and training.

Q2.1 Please select the 4 areas where you think you are most skilled
(number your choices with 1 being the area where you are most skilled).

____Labour management

____Machinery operations/maintenance

____Information technology (use of internet, GPS, computer software programs, etc)

____OH&S or WH&S

____Business/financial management

____Marketing

____Compliance/quality systems

____Irrigation management

____Pest & disease management

____Soil/nutrient management

____Other aspects of technical farm management (e.g. varietal selection)

____Other *(please specify)*_____

Q2.2 Please select the 4 areas where you think you are least skilled
(number your choices with 1 being the area where you are least skilled).

____Labour management

____Machinery operations/maintenance

____Information technology (use of internet, GPS, computer software programs, etc)

____OH&S or WH&S

____Business/financial management

____Marketing

____Compliance/quality systems

____Irrigation management

____Pest & disease management

____Soil/nutrient management

____Other aspects of technical farm management (e.g. varietal selection)

____Other *(please specify)*_____

Q2.3 Please select 4 priority areas where you would like to improve your skills over the next 3-5 years *(number your choices with 1 being your highest priority).*

____Labour management

____Machinery operations/maintenance

____Information technology (use of internet, GPS, computer software programs, etc)

____OH&S or WH&S

____Business/financial management

____Marketing

____Compliance/quality systems

____Irrigation management

____Pest & disease management

____Soil/nutrient management

____Other aspects of technical farm management (e.g. varietal selection)

____Don't plan on doing any upskilling in the next 5 years

Q2.4 What are the 3 main factors that motivate you to undertake training? *(Number your choices with 1 being your biggest motivator.)*

____Required by customers (e.g. to meet quality standards)

____Required by legislation (e.g. OH&S or WH&S)

____Want to improve business management

____Want to increase profitability

____Want to improve technical on-farm knowledge

____Want to increase production efficiency

____Want to decrease reliance on external advisors

____To improve the safety of the business/operation

____To increase job satisfaction/reward

____Other (please specify)_____

Q2.5 What are the 3 main factors that most discourage you from participating in training? *(Number your choices with 1 being the most discouraging.)*

____Training not available at a suitable location

____Training not available at a suitable time of day

____Training not available at a suitable time of year

____Training not avilable in a suitable format (e.g. on-line, informal workshop, formal course)

____Time constraints (too busy)

____Cost constraints (too expensive)

____Not aware of suitable programs or business-specific requirements are not being met by existing programs

____Quality of available training programs

____Quality of available training providers

____I don't know where to go to find out about training

____Course content too academic/not practical enough

____Other *(please specify)*_____

Q2.6 Select your top 3 preferred ways of learning *(number your choices with 1 being your first preference).*

____Attend formal training courses

____Units/subjects of interest rather than commit to a whole course

____Attend informal training sessions if the opportunity arises (e.g. field days, workshops)

____Participate in informal discussion groups (which are ongoing)

____Read factsheets, articles in grower newsletters/magazines/papers

____Use the internet to read articles

____Use tools (e.g. spreadsheets which have been developed especially for growers), without attending any training sessions

____Use the internet to study (e.g. on-line discussion or study forums)

____Use a mixture of on-line and in person training

____Receive independent advice/support one on one

____Receive advice/support from a product/machinery supplier

____Webinar

____Other *(please specify)*_____

Q2.7 What training providers have you used in the last 2 years for training for yourself?
Please select all options that apply.

◯ Department of agriculture/primary industry in your area

◯ State industry bodies (e.g. VGA Victoria, Growcom, TFGA, Grow SA)

◯ TAFE (or other vocational educational provider)

◯ University/specialist agricultural college

◯ Private registered training organisation (RTO)

◯ Training provided on the job by other workers

◯ Information shared by agricultural advisors/consultants

◯ I have not used any training providers in the last 2 years

◯ Other *(please specify)*_____

Q2.8 How much do you value the following learning tools?

	A Lot	Some	Little	None
Case studies (i.e. reading about experiences/ learnings of other vegetable producers)	◯	◯	◯	◯
Benchmarking/grower discussion groups	◯	◯	◯	◯

Q2.9 How much do you use tools (e.g. spreadsheets, calculators, factsheets) which have been developed for the vegetable industry? *Select the option that applies to you.*

- ◯ Never
- ◯ Only when I am trained to use them during a workshop/field day
- ◯ Only if I am introduced to them by an extension officer/field officer, etc
- ◯ I ask extension officers/field offiers about available tools/factsheets if I have a specific problem/question
- ◯ I actively search on the internet for tools/factsheets when I have questions/need help
- ◯ Other *(please specify)*_____

Q2.10 Would you be more likely to use tools (e.g. spreadsheets, calculators, factsheets) if they were in App form and available on your phone?

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ I don't have an iPhone/smart phone

Q2.11 How do you find out about tools/research outcomes? (i.e. How is R&D effectively passed on to you?) *Please select as many options as apply to you.*

- ◯ From neighbours/friends
- ◯ From external advisors (e.g. field officers, financial advisors)
- ◯ From extension staff (industry body) who visit you
- ◯ From government agriculture/primary industry department extension staff who visit
- ◯ At workshops/field days you attend
- ◯ From articles in farming newspapers/magazines
- ◯ Through webinars
- ◯ From information provided by peak bodies or associations (e.g. AUSVEG, Growcom, etc)
- ◯ Other *(please specify)* _____

Q2.12 Can you list any training programs/courses, field days, or workshops that you have attended in the last 12 months?

_____

_____

_____

Q2.13 Can you list any training tools (e.g. factsheets, case studies, calculators) that you have used in the last 12 months?

_____

_____

_____

The following questions ask about your employees' skill and training. If you don't have any employees, please skip straight to question 4.1 to complete the survey.

Q3.1 What is the maximum number of permanent (full time or part time) employees that you would employ in a typical 12 month period?

_____

Q3.2 What is the maximum number of seasonal/itinerant employees that you would employ in a typical 12 month period?

_____

Q3.3 What is the maximum number of permanent casual employees that you would employ in a typical 12 month period?

_____

Q3.4 How many apprentices/trainees do you employ?_____

Q3.5 What are the main skills/qualifications/attributes you look for when you are employing a new person?
(Please number your top 3, with 1 being your first preference.)

____Willingness to learn

____Formal VET qualification (e.g. Cert 1, 2, 3 or 4)

____Previous practical on-farm experience

____Licence/ticket to operate (e.g. chemical handling, ATV course, forklift course, etc)

____Good literacy/numeracy skills

____Good work ethic

____Social skills/fits in with organisational culture

____Other *(please specify)*_____

Q3.6 Overall, how satisfied are you that your staff have the key skills needed to do their jobs well?

◯ Very dissatisfied

◯ Dissatisfied

◯ Satisfied

◯ Very satisfied

Q3.7 What is the main type of training that your staff undertake?
(Please number your top 3 options with 1 being your first preference.)

____Informal on-the-job training and/or orientation from existing staff

____Structured on-the-job training (not part of a qualification)

____Apprenticeship or traineeship, all on-the-job

____Apprenticeship or traineeship, both on- and off-the-job

____Other formal course

____Informal course (e.g. field day or workshop)

____None at all

____Other *(please specify)*_____

Q3.8 Why do you provide training for your staff?
(Please number your top 3 options, with 1 being your first preference.)

____Because of technological change or new work or management practices

____To improve the efficiency of the business, including to orientate new staff to the business or industry

____To improve the quality of the products or services of the business

____To provide a career path or opportunities for employees

____To retain employees

____Legal, award or other requirements

____Market requirements

____Other *(please specify)*_____

Q3.9 Do you think the range of VET courses on offer at TAFE/RTO/etc in your area meet the needs for up-skilling your staff?

◯ Yes

◯ No

Q3.10 If NO, what would improve the course offerings? *Please select all the options that apply.*

◯ More courses specific for vegetable production

◯ More practical courses

◯ More business courses

◯ Shorter courses

◯ More experienced, industry-based trainers

◯ More on-line courses

◯ Better on-farm assessments

◯ Better co-ordination between the institution and the employer

◯ Other *(please specify)*_____

Q3.11 Any other comments about provision of VET training by RTOs/TAFE?

_____

_____

_____

_____

Q3.12 What factors would encourage you to provide training for your staff?
(Please number your top 3 options, with 1 being your first preference.)

____Technological change or changes to work practices

____Improved business profitability

____Hiring new staff

____Legal, award or other requirements

____Subsidies or other financial or business incentive

____More courses relevant to your business

____More on-the-job training

____More off-the-job training

____Training in a more convenient location

____Training at a more convenient time

____Less staff turnover/ more stable workforce

____More on-line training options

____Other *(please specify)* _____

Q4.1 What are the key areas where you have used outside skills (i.e. used contractors/agronomists/field officers/ marketers/financial advisors) in the past 12 months, rather than upskill yourself or your workforce?
(Select as many options as you like.)

◯ Labour management

◯ Machinery operations/maintenance

◯ Information technology (use of internet, GPS, computer software etc)

◯ OH&S or WH&S

◯ Business/financial management

◯ Marketing

◯ Compliance/quality systems

◯ Irrigation management

◯ Pest & disease management

◯ Soil/nutrient management

◯ Other aspects of technical farm management (e.g. varieties)

◯ Other *(please specify)* _____

Q4.2 What do you think the best investment of the vegetable levy would be in the area of skills and training?

_____

_____

_____

_____

_____

Appendix 3. Copy of media articles

The following media articles appeared in Vegetables Australia magazine.

The skills and training survey article appeared in the Sept/Oct issue.

The investing in a valuable asset article appeared in the Nov/Dec issue.

Skills and Training Survey for vegetable growers

Participate in a review of skills and training within the vegetable industry and be in the running to win an iPad.

As with all sectors of agriculture, skills and training within the vegetable industry is an important issue. AUSVEG has been contracted by Horticulture Australia Limited to conduct a National Skills and Training Scoping Study, in order to identify the key areas of need for growers on-farm with respect to skills and training. This will be a broad ranging review that will encompass all aspects of farm operations, including technical, practical, business and information technology needs.

It is critical that we get an informed view from growers on this issue, so that the industry can get the investment correct when it considers the best way to address skills and training needs using the National Vegetable Levy. AUSVEG has subcontracted the review of the skills and training needs in the vegetable industry to Macquarie Franklin, an experienced agricultural consultancy firm based in Tasmania.

Macquarie Franklin has produced a survey to obtain information from growers on skills and training within vegetable growing businesses. A hardcopy of the survey has been included in the plastic package you received this magazine in. It has also been made available on the internet.

To complete the survey electronically, visit www.ausveg.com.au/survey.

The survey will be open from 14 September to 14 October 2012. Your input is highly valued.

AUSVEG is offering an iPad prize (to be randomly drawn) to one lucky grower who completes the survey. To be in the running for this great prize and to provide your feedback on the skills and training the industry needs to grow and prosper, please take the time to complete the survey. Macquarie Franklin will also be contacting some individuals in each state to see if they are willing to take part in a face-to-face or a phone conversation about the survey.

Investing in a valuable asset

A comprehensive AUSVEG and HAL conducted survey will seek to unearth the critical skills needs of growers.

An oft repeated saying in business is that 'your people are your most valuable asset.' As part of a project focused on industry development needs in the vegetable industry, AUSVEG has been contracted by Horticulture Australia Limited (HAL) to consider the emerging requirements of growers with regards to skills and training in their businesses.

Tasmanian-based consulting firm Macquarie Franklin has been brought in to complete interviews with growers around the country and to survey them in order to report back on the areas of greatest need.

"This comprehensive national consultation with growers will allow both AUSVEG and HAL to better understand what growers need in terms of skills and training resources and programs," said AUSVEG Manager of Industry Development and Communications, Andrew White. "This will ensure that the relevant investment committees are fully informed about their colleagues' requirements, so that the vegetable industry can confidently invest in future programs focused on training and skills."

Mr White said that the review had been broad ranging and had included all aspects of farm operations including technical, practical, business and information technology needs.

"When the report is finalised towards the end of this year, it will inform future vegetable industry investment to address skills and training needs using the National Vegetable Levy," said Mr White.

The AUSVEG development project has also been working to improve access to the Knowledge Management R&D database that is accessible on the AUSVEG website, www.ausveg.com.au. Vegetable growers and industry members are encouraged to jump online and register to access the website's R&D database, which now includes a wealth of resources including almost all of the HAL-funded R&D that has been completed over the past decade.

Recent improvements mean that when you login, new research that is most relevant to the crops you are interested in will be automatically displayed on-screen. Improvements have also been made to make access to the database's search function easier and to display search results in a more user-friendly way, with a greater range of options now available to sort through the results. Registration is free, so visit www.ausveg.com.au now to join and take advantage of this valuable resource.

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Appendix 2

Review of the domestic and international data requirements for the Australian vegetable industry (final report by Dr Ben O'Neill).

Review of the domestic and international data requirements for the Australian vegetable industry

November 2012

Issue 1.2

This project was funded by HAL using the National Vegetable Levy and matched funds from the Australian Government.

Report No. AV12/1, Issue 1.2.

Report commissioned by AUSVEG Ltd (ABN 25 107 507 559)
Written by Dr Ben O'Neill, Statistical Consultant (ABN 26 470 671 496)

The present report is written by a statistical consultant at the request of AUSVEG Ltd. The opinions presented in this report are those of the author and do not necessarily reflect the position of AUSVEG Ltd or any related entities or staff.

Thanks for assistance

Thanks are due to the following people for their assistance with information for this project: Mr Andrew White, AUSVEG; Mr Ian James, Industry Data Economic Analysis (IDEA); Ms Rattana Warren, Australian Bureau of Statistics (ABS), Ms Therese Thompson, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES); Ms Clair Angel, Australian Productivity Commission (APC); Ms Marian Sheppard, Commonwealth Scientific and Industrial Research Organisation (CSIRO); Mr Peter Greagg, Australian Treasury Economist. Each of these individuals provided valuable assistance to the consultant in the course of the present work. Any omissions or errors remain the responsibility of the author.

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GLOSSARY OF ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABN	Australian Business Number
ABR	Australian Business Register
ABS	Australian Bureau of Statistics
ABSBR	Australian Bureau of Statistics Business Register
AFMA	Australian Farmers Market Association
ANZSIC	Australian and New Zealand Standard Industry Classification
APC	Australian Productivity Commission
ATO	Australian Taxation Office
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
EVAO	Estimated Value of Agricultural Output
FAO	Food and Agriculture Organisation (United Nations)
GST	Goods and Services Tax
GTIS	Global Trade Information Services Inc
HAL	Horticulture Australia
LRS	Levies Revenue Service

GLOSSARY OF TECHNICAL TERMS

Population: This is the total group of people of interest in a statistical problem.

Sample: This is a subgroup of people selected by a surveyor to study the characteristics of the wider population of interest. The observed characteristics of the sample are used to make judgments and estimates about the characteristics of the wider population.

Sampling Frame: Sometimes also referred to simply as a **frame**. This is the source from which a statistical sample is drawn. Usually it is a list of members of a population of interest, though it need not (and usually does not) align exactly with the population of interest.

Participant: A person selected from the sampling frame to participate in the survey (even if the person does not respond). The person is sent a survey and given an opportunity to respond.

Respondent: A survey participant who responds to the surveyor.

Stratified Sampling: This is a method of sampling where the total group of people in the whole sampling frame are separated into mutually exclusive groups and samples are taken from each of these groups. Data from respondents in each group are then reweighted according to their proportion in the sampling frame to give estimates pertaining to the total group as a whole.

Correlation: Correlation is a measure of the relationship between two quantities. In statistics, correlation is measured by a "correlation coefficient" which is a number between negative one and positive one. A correlation coefficient of negative-one means that the two quantities have perfect negative correlation, meaning that higher values of one quantity always go with lower values of the other (and vice versa). A correlation coefficient of positive-one means that the two quantities have perfect positive correlation, meaning that higher values of one quantity always go with higher values of the other. A correlation coefficient of zero means that the two quantities are uncorrelated, so that there is no tendency for higher values of one to go with either higher or lower values of the other.

Rank-Correlation: Rank-correlation is a measure of correlation used for ordinal responses. This measure of correlation only uses the ordering information in the responses.

Ordinal Response: An ordinal response is a response that is on an ordinal scale, meaning that the possible answers have a meaningful order but do not give any meaningful quantitative information beyond this. Ordinal responses occur when there is a ranking of answers in a vague qualitative fashion, such as the ranking of Not useful / Somewhat useful / Useful / Very useful. Ordinal responses require special statistical techniques to analyse.

Ordinal dominance: Ordinal dominance occurs in the comparison of data on ordinal responses when the cumulative counts of data in one category are all above/below the cumulative counts of data in the other category. Strict ordinal dominance occurs when this holds and there are no ties in the cumulative counts.

EXECUTIVE SUMMARY

Present data provided by AUSVEG is contained on its website, both on the public pages and the members pages for vegetable growers. The reports on the website give supply-side information regarding production by growers, characteristics of growers and farms, and financial and trade data. The reports also give demand-side information regarding purchasing and consumption by consumers and characteristics of consumers. Some of the information is for specific types of vegetables and some of the information is aggregated across all types of vegetables.

The supply-side data on the AUSVEG website is mostly sourced from the ABS, ABARES and GTIS. The demand-side data is sourced from Nielsen and Freshlogic. The documents give data tables and accompanying graphs but do not give much specific sourcing information or methodological discussion. There is presently insufficient information in the reports for a general reader to identify the specific source of most of the information. (Sourcing statements in the documents mostly give a general reference to the agency the data is sourced from, without a reference to a specific document and page.)

Needs of growers: In order to assist in understanding the data needs of Australian vegetable growers the present consultant and AUSVEG conducted an online survey of vegetable growers in the AUSVEG contact list. The consultant also contacted a selection of growers referred by AUSVEG to conduct follow-up interviews regarding their data practices and opinions on their data needs. This survey had 120 eligible respondents and the follow-up contacts garnered 11 successful interviews. (Some of the growers in the follow-up interviews were respondents to the survey and some were not.)

The respondents to the online survey and follow-up interviews tended to be larger growers. To account for this the consultant analysed both the raw data from the survey and scaled estimates that were calculated by adjusting the weightings of the responses to compensate for the overrepresentation of large growers.

The overall picture that emerged from the survey data is that growers are primarily interested in data accuracy and timeliness. They also have some interest in sourcing and methodology, and larger growers have an interest in historical comparison with past data. Growers find price data to be the most useful category of data, followed by consumption and marketing data. Other useful categories of data are climate and weather data, and vegetable use and yields. Growers

are less interested in data on trade and financial performance, farm and grower characteristics, growing conditions and production data, and data for growers outside Australia. The larger growers tend to be more interested in statistical data and also use it more in their business decisions.

Around two-third of growers were already aware of the statistical information on the AUSVEG website prior to doing the survey, and of these, most have accessed information from the site. Those growers that accessed information tended to access only a few categories of information, but some of the larger growers have accessed all categories of information on the website.

Around two-thirds of growers use statistical data for general interest/education. This form of usage is also a good predictor of usage for business-related decisions. More than half of growers use statistical data for short-term business decisions and more than half of growers use statistical data for long-term business decisions. (These uses are only weakly correlated.) Larger growers are more inclined to use statistical data for long-term business decisions than smaller growers. Slightly less than half of all growers use statistical data for marketing and business comparison/benchmarking. Larger growers are more inclined to the latter than smaller growers. Few growers use statistical data to lobby government, and this is almost exclusively larger growers.

Availability of data: The consultant investigated available data from a number of agencies including the ABS, ABARES, APC, FAO, ATO, CSIRO, Nielsen, Freshlogic, IBISWorld and vegetable markets. Most of these agencies have original data that they have obtained through their own surveying activities but some rely on data from other agencies. This investigation showed that there are a number of data sources that are not yet being fully exploited by AUSVEG.

The ABS conducts regular agricultural surveys to obtain information about producers in the agricultural industry. This includes a census conducted once every five years. From these surveys the ABS provides a large amount of data related to the vegetable industry. Relevant catalogues of data are set out in Table D.1 in Appendix D. Data is published by the ABS in the form of reports and data spreadsheets with a small amount of the information being included in interactive maps. This is supplemented by a facility developed by HAL called HORTSTAT, which allows users to generate time-series plots of ABS data. ABS data is also sourced in a general data facility for worldwide agricultural statistics. This is a facility developed by the FAO called FAOSTAT, which allows users to generate time-series plots and maps of worldwide data.

One of the main drawbacks of the ABS data is that the categories used are inconsistent and do not give a detailed breakdown for many specific types of vegetables. Contact with growers suggested that a more detailed categorisation of data would be useful. Data from ABARES has a different class of vegetables than the ABS data, and this source is based on smaller samples and is paid for by outside agencies.

Demand-side data is available from Nielsen, Freshlogic and from market reports from various vegetable markets around Australia. AUSVEG already use information from both Nielsen and Freshlogic but do not presently have any information available from market reports. Relevant reports of data from agencies other than the ABS are set out in Table D.2 in Appendix D.

Reliability of data: Based on descriptions of methodology the reliability of supply-side data from the ABS and ABARES and demand-side data from Nielsen and Freshlogic was assessed. The time available for the project and limitations on access to the raw data did not allow deeper investigation based on internal audit of the survey practices. This means that the analysis of reliability was limited to an identification of the possible sources of error and an assessment of the sources of error that are most likely to occur based on the methodology and surrounding information. It was not possible to quantify the amount of error in the surveys.

The main potential sources of error in the ABS and ABARES data were the regular form of sampling error that arises in any partial sample of the population, and potential measurement error due to incorrect reports by growers. The level of likely sampling error is quantified in the relevant reports, but this could be improved. The measurement error cannot be quantified but anecdotal evidence suggests that it may be substantial. In particular, anecdotal evidence from contacts with growers and other industry participants suggested that a small number of growers either have difficulty giving high-quality information based on the types of questions in the surveys, or do not trust the surveyors enough to give high-quality information.

The main potential sources of error in the Nielsen and Freshlogic data were the regular form of sampling error that arises in any partial sample of the population, and potential sampling frame error due to the fact that the surveys rely on self-selection of participating consumers.

Summary of recommendations: Recommendations in this report are set out in the body of the report and also replicated in the section on the plan for continuing access to data. As is explained more fully in the latter section, these recommendations are designed to accomplish

three main goals. The first is to engage with the ABS to influence its surveying activities and improve the quality of data from this source. The second is to fill existing gaps in data on the AUSVEG website with identified sources of available data. The third is to improve the quality of the data presented on the AUSVEG website.

The specific recommendations address these three matters by giving specific advice for actions and procedures that should be adopted by AUSVEG. Broadly speaking, these recommendations are for specific types of engagement with the ABS and specific goals and proposals in this engagement, improvements to sourcing practices in AUSVEG data, increased coverage of some available data sources, and actions to encourage growers to provide better quality data. The recommendations are directed to AUSVEG rather than to vegetable growers, but some of the recommendations may nonetheless be interesting to growers.

Overview of this report: The present report is divided into six chapters progressing logically through the analysis. Chapter 1 gives an introduction and discussion of the scope of the project. Chapter 2 discussed present data sourcing practices at AUSVEG. Chapter 3 discusses the survey of vegetable growers and analyses the data from this survey to establish grower needs. Chapter 4 looks in detail at the sampling frame used for surveying by government agencies such as the ABS and ABARES. Chapter 5 sets out an account of available data sources that may be relevant to vegetable growers. Chapter 6 discusses the reliability of these various data sources and the sources of error in them.

PLAN FOR CONTINUED ACCESS TO DATA

In this present section we set out a plan for continued access to data and improvement in present data use. Since the core set of data in Australia that is available without cost to the user is ABS data from its agricultural surveys it is sensible that our plan for continued access must secure and improve this source as best can be achieved. It also makes sense to fill present gaps in coverage using the available sources of data we have identified. Finally, continued access to data is improved by the improvement of data quality in the available data sets.

Clearly no plan by AUSVEG can guarantee continued access to data, since this data is surveyed and compiled by outside agencies. Access to data depends on continuing actions by outside agencies to obtain and compile this data. Nevertheless, there is a certain amount of core data available from the ABS under its Basic Information Set. If this source of data can be improved then this would lead to a stable and reliable long-term source of data that would be continually accessible to AUSVEG. The best that can be achieved here is to work to improve the core data, identify potential sources of data both from the ABS and other providers, assess the relevance of these sources relative to knowledge of the needs of vegetable growers, fill gaps in present knowledge using available and accurate data sources, and work with agencies that provide data to give information about data needs. This process is set out in Figure P.1 below.

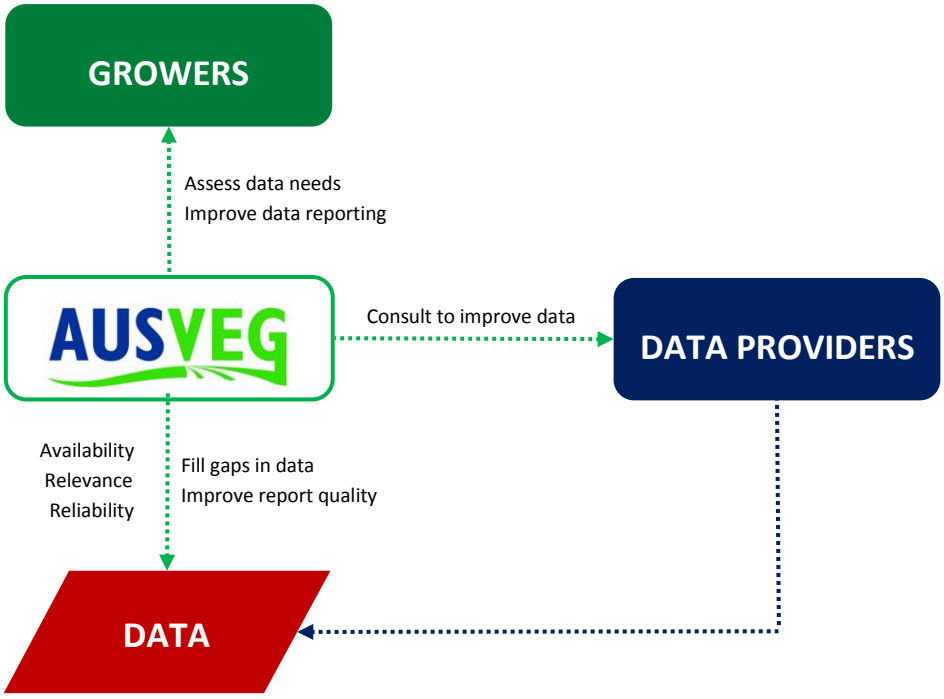


Figure P.1: Structure of plan for continued access to data

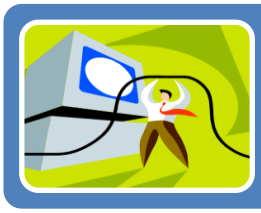
Based on this structural setup, the present plan for continued access to data consists of three elements set out below. This includes engaging in consultation with the ABS, filling present gaps in coverage, and improving the quality of present data sets. Each of these elements are covered by recommendations set out in the body of this report and reproduced below.

Engage in consultation with ABS

- Make efforts to maintain and extend the Basic Information Set
- Recommend improvements to data (e.g., more veg categories)
- Consider strategies to reduce measurement error by growers
- Recommendations: 5, 6, 7, 8, 14, 15

Fill present gaps in coverage

- Link to online databases and major reports
- Review catalogue of reports for useful information
- Keep internal record of problems in data reliability
- Recommendations: 1, 2, 4, 9, 10, 11, 12, 13



Improve quality of present data sets

- Add sourcing and methodology information to data sets
- Consider improvements in functionality (e.g., interactive)
- Encourage growers to improve their survey data
- Recommendations: 2, 3, 15

Specific recommendations on these matters are set out below. These recommendations are addressed to AUSVEG rather than to vegetable growers, though vegetable growers may also find some of these useful. Recommendations are also set out in the main body of the report and justified by surrounding discussion.

> **Recommendation 1:** To the extent practicable, AUSVEG should keep a record of instances in which published data it uses conflicts with other information sources (even in cases where this is merely anecdotal evidence from growers). This record should set out instances in which staff at AUSVEG have reason to believe that reported data may be inaccurate or flawed. This record should include instances where this occurs, details of the data source under consideration, and details of the conflicting evidence (even if this is only an anecdotal report). If it is not practicable to record all such instances then AUSVEG should attempt to record any instances that lead them to major concerns about the quality of reported data.

Recommendation 2: AUSVEG should implement a workplace system to ensure that data on its website is updated promptly once new data becomes available. AUSVEG should also consider implementing a system of email notifications to allow growers to get immediate notification of updates to data sets of interest to them. (Since growers with membership access on the AUSVEG website already enter information on their activities for the purposes of providing suggested reports, it might be possible to build a system of email notifications into this.)

Recommendation 3: AUSVEG should update the existing statistical information on its website to give details on the data source and a referral to discussion of the methodology used for data collection. For ABS data this can be done by including specification of the relevant report and page number that the data was taken from (not just the name of the agency) and a reference to the page numbers in the ABS report where the methodology of data collection is discussed. (Usually this is in explanatory notes at the end of the ABS report.) Depending on the formatting and medium of the AUSVEG document, references or hyperlinks to the primary source document at the ABS could also assist growers in this regard.

Recommendation 4: In targeting statistical information to growers AUSVEG should concentrate on providing information to growers that show evidence of having a general interest in statistical data. This is not only valuable in the obvious sense of targeting to an audience that is interested in the product; it is also useful since this characteristic appears to be a good predictor of use of data in business decisions (i.e., growers with a general interest in statistical data are more likely to use this data in their business decisions).

Recommendation 5: AUSVEG should consider taking action to obtain improved business count data from the ABS. This should include breakdowns of business counts for categories of interest to AUSVEG and growers, as well as conjunctions of the various categories in cases where these counts include secondary activities by businesses. (Note: Some data of this kind is reported in some years so it may fall within the core business of the ABS. Unfortunately the data that is presently reported is not sufficiently consistent in its form to permit useful results.)

Recommendation 6: AUSVEG should consider participating in the consultation process for the ABS agricultural surveys (including the agricultural census). In particular, AUSVEG should consider making a submission to the ABS on desirable information to include in the Basic Information Set as "essential information" obtained from the surveys. AUSVEG should also alert vegetable growers to this process and encourage them to participate where desirable. AUSVEG should approach this activity with a view to improving the next ABS Agricultural Census which is due to be conducted in 2015-16.

Recommendation 7: Data going beyond the published ABS reports is available on a "cost recovery" basis through the Information Consultancy Service at the ABS. Notwithstanding this fact, AUSVEG should exhaust all legitimate avenues of influence over the Basic Information Set before making any large commitments to pay for additional data.

Recommendation 8: AUSVEG should encourage the ABS to work towards surveys that offer consistent and detailed categories for vegetable growing activities. The categories should include breakdowns according to specific types and subtypes of vegetables. In cases where data on categories is given, the ABS should report data on each of the categories and report sufficient information on any overlaps between these categories to allow calculations for all possible conjunctions and disjunctions of the relevant categories.

Recommendation 9: AUSVEG should consider providing a link for growers to the HORTSTATS database on its website.

Recommendation 10: AUSVEG should review the reports in the catalogues set out in Appendix D of this report and consider whether any of the data in these reports is suitable for its Industry Statistics webpage.

Recommendation 11 AUSVEG should consider providing a link for growers to the FAOSTAT database on its website. AUSVEG should also take note of this facility in cases where comparative analysis between the Australian industry and countries is required. This facility can be regarded as an example of a well programmed data facility with excellent functionality.

Recommendation 12: AUSVEG should continue to provide demand-side statistics and reports to growers. AUSVEG should also consider purchasing industry reports for its own information. It is unlikely that these reports could be given to growers, but AUSVEG could use the information in the reports to assist its advice on the state of the vegetable industry and give its own advice to growers on these matters.

Recommendation 13: Reporting of market information from vegetable market reports is unlikely to be feasible due to cost and availability constraints.

Recommendation 14: In consultation with the ABS and ABARES, AUSVEG should enquire into the standard error measures presented in the statistical reports to ensure that the appropriate correction term for inference to a finite population is included (either in the standard error measure or as a separately reported term). This would require technical consideration from the ABS and ABARES as to the best method of presentation of the relevant statistics.

Recommendation 15: In consultation with the ABS and ABARES, AUSVEG should consider strategies for encouraging growers to improve the accuracy of data they give in the agricultural census and surveys. This should focus on attempts to engage with the small number of growers who do not give accurate data. AUSVEG should also encourage the ABS to review the questions in its agricultural surveys to ensure that they correspond well to the practices of growers and are not unnecessarily difficult for growers to answer. AUSVEG should obtain and review the questions in the Agricultural census and surveys with a view to determining whether or not these accord with the accounting practices of growers.

Implementation of these recommendations should improve the quality of present data supplied by AUSVEG and also assist AUSVEG to secure long-term access to reliable data on the vegetable industry.

1. Introduction and scope of report

The present report is a review of the data needs of the Australian vegetable industry. It consists of an analysis of the data needs of vegetable growers and an examination of sources of data that pertain to vegetable growers operating in Australia. This report was commissioned by AUSVEG as part of its review of its existing data-sourcing practices.

The report consists of an assessment of the present data sourcing practices at AUSVEG, a survey and analysis of the data needs of Australian vegetable growers, a review of the sampling frame used for surveying work by government agencies, an assessment of the available sources of data on issues pertaining to the vegetable industry, and a plan for long-term access to reliable data on vegetable production and the vegetable industry. The report provides recommendations to AUSVEG on a range of issues relating to industry data. These recommendations form part of an overall plan for long-term data access requirements.

In its initial briefings on the project AUSVEG advised that it has occasionally received anecdotal information from growers and other sources that conflicts with information in some of the data sourced from the ABS and other agencies. There is no systematic record of this anecdotal evidence, but this has apparently occurred from time-to-time. These anecdotal reports have led to questions over the accuracy of various sources of data and consequent difficulties in assessing the soundness of strategic plans based on this data. As a result, a major part of the focus of this project is to determine whether or not the data being sourced is likely to be reliable, and if not, to determine what action AUSVEG can take to improve reliability of the data it sources over the long-term.

The analysis of available data in the present report is limited to the types of data identified in the review document provided by AUSVEG as part of the initial briefing for this project. This is limited to data that is pertinent to the activities of Australian vegetable growers; it does not include a comprehensive review of information on the international vegetable market. Though the title of the project refers to "domestic and international data requirements" the focus is on the needs of Australian growers. (The reference to international data means that we consider data on trade and other "international" issues where it is of interest to vegetable growers in Australia.)

The types of data reviewed as part of this report are measures pertaining to the production of vegetables by Australian vegetable growers, trade of vegetables (including import/export of vegetables), characteristics and financial performance of Australian vegetable growers. We also reviewed some sources of data on consumption of vegetables and growers outside Australia though this was not a comprehensive analysis. Types of data **not** reviewed as part of this report are data on legislative/policy instruments affecting vegetable growers, nutritional information about vegetables, and climate and weather data. Although the latter data types were not reviewed in the section reviewing available sources of data, the survey of growers includes questions about data needs pertaining to climate and weather data. This was included to see if a wider investigation into data sources may be warranted in future projects.

Briefings with AUSVEG made clear that their representative responsibilities are to the vegetable industry as a whole and not to any specific growers. Throughout the report we try to explain how the data needs of different types of growers differ in cases where this is evident from the information available. In particular, we look at the differing data sourcing practices and data needs of large and small growers and give recommendations based on this information. Of necessity, any recommendations designed to improve the productivity of the industry as a whole will tend to give high weight to factors affecting large producers. This is further exacerbated by the fact (which we will discuss later) that larger producers tend to be more sophisticated in their use of statistical data, and more open to using statistical information in their business decisions. In this report we make recommendations based on what is likely to be valuable for the industry as a whole.

This report should not be taken as a definitive work on data sourcing practices for the vegetable industry. Though there is a wide scope to the present project it can best be regarded as an opening investigation into data issues in the industry. The report provides recommendations that include further engagement with government agencies that provide data. Here we set out what kinds of data objectives should be pursued and how they can be pursued by AUSVEG as part of a long-term plan. If these recommendations are adopted then it is likely that this would lead to further engagement with government statistical agencies and other data providers which would give rise to further specific issues that need consideration. In the present report we give an analysis of the data needs of the industry which is sufficiently comprehensive to give broad recommendations for long-term access to reliable data.

2. Present data sourcing practices at AUSVEG

The representative role of AUSVEG is conducted in tandem with a levy system imposed by the Australian Government on vegetable growers in Australia. Australian vegetable growers are subject to a National Vegetable Levy system imposed by the Australian Government, which is used to fund research activities and other activities in the industry.[1] This levy is administered by the Levies Revenue Service (LRS) which forms a part of the Department of Agriculture, Fisheries and Forestry (DAFF). Publications related to the levy system, including levy rates and financial returns are available from the Levies Revenue Service.[2]

AUSVEG represent the industry as a whole, and thus represent all levy payers in the system. Their role in the levy process "...is limited to recommending to HAL about the composition of the Vegetable and Potato Industry Advisory Committees (IAC)"[3] but they have a wider role as a representative body for the industry. AUSVEG presently have a contact list of growers that has been formed over time from contacts with identified growers working throughout Australia. However, neither AUSVEG nor any other agency has a list of all growers who pay the levy.

Ordinarily a levy system might be expected to give rise to a list of registered levy payers that could be used as a comprehensive sampling frame for surveying work in the industry (assuming that the list is made available from the government agency that collects the levy). However, in the case of the vegetable levy the payment is remitted mostly by wholesalers who purchase vegetables from the vegetable growers rather than from the vegetable growers themselves. (In cases where growers sell vegetables directly to consumers they are required to submit levy payments directly to LRS. However, in the more common case where growers sell to a wholesaler such as Woolworths or Coles, the latter organisation remits the levy to LRS.) This means that there is no record of vegetable growers who pay the levy — the LRS would have a list of growers who pay the levy directly, but would not have information on the growers that pay the levy through an intermediary. This means that AUSVEG is in the unenviable position of representing a group of growers that it cannot actually identify with precision. There does not appear to be any definitive source which would allow AUSVEG to contact —or even identify— all the vegetable growers it represents.

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[1] DAFF • *Levy Principles and Guidelines* • January 2009.
[2] See http://www.daff.gov.au/agriculture-food/levies/publications
[3] AUSVEG • *The Levy System* [Last accessed on 21 November 2012]
http://ausveg.com.au/intranet/technical-insights/your-levy-at-work/the-levy-system/overview.htm

2.1. Data published by AUSVEG on its website

AUSVEG are limited in their capacity to survey growers by the fact that they rely on a contact list with only partial coverage of this group. This impediment means that data sourcing at AUSVEG relies almost exclusively on data published by outside agencies, mostly government agencies. The latter have developed more reliable lists of businesses engaged in vegetable growing that can be used as a sampling frame for surveying work. (We discuss this in more detail later.)

As part of its advisory role to Australian vegetable growers AUSVEG publishes reports and data on matters pertaining to the vegetable industry in Australia using information from outside agencies. Some of this information is contained on public parts of the AUSVEG website and some further information is contained in a members-only area for growers; the latter requires login and password information to access.

AUSVEG Industry Statistics page: Publicly available data is accessible on the AUSVEG webpage through its "Resources" section. This section includes "Industry Statistics" with reported data on a number of areas of potential interest to vegetable growers.[4] Data in this section is sourced primarily from the Australian Bureau of Statistics (ABS) and the Global Trade Atlas published by Global Trade Information Services Inc (GTIS). The present information on the AUSVEG Industry Statistics webpage includes several categories with the following information:

- **The Domestic Industry:** This category includes statistics on vegetable production (land use, volume, yields, planting, diversity, etc.), farm sizes and characteristics (number of vegetable establishments, farm size, etc.) and economic data on vegetable farms (value of production, earnings, etc.).
- **Vegetable Spotlight:** This category includes statistical reports on specific vegetables, including information on planting, production, yield, price, trade, market uses, etc.
- **Trade in Vegetables:** This category includes statistics on international vegetable trade, including information on destinations for trades and the value of traded goods.
- **Vegetable Industry Financials:** This category includes statistics on the financial performance of firms in the Australian vegetable industry. This includes information on income, costs, profits, cash receipts, rates of return, components of costs, etc.
- **Discussion Papers:** This category includes general discussion papers on the vegetable industry. These discussion papers do not appear to include any additional statistical information. Rather, they contain analysis of industry issues.

[4] See http://ausveg.com.au/resources/industrystatistics.htm. Accessed 21-26 September 2012.

Data source information on these documents is presently quite sparse and inconsistent. Some reports are identified as having been prepared by outside statistical agencies.[5] Some documents identify the source agency for the data (e.g., ABS) but do not refer to any particular document or report containing the reported data.[6] (Most documents are of this kind.) Other documents do not refer to the source of the data at all.[7] From the data that is sourced, it appears that most of the present data is from the ABS, though it is not immediately clear which specific reports these data sets are sourced from. (The present author has been able to identify the source of many of the reported statistics from present ABS publications.)

AUSVEG members page (internal): Internally available data is accessible on the member page of the AUSVEG webpage. This requires a registered login and password to access. This internal page includes access to:

- **R & D Database:** This is a searchable database containing summaries and details of research reports that are available from AUSVEG. These are research projects funded by HAL using the proceeds of the Vegetable Growers Levy.
- **Nielsen Vegetable Market Reports:** This includes demand-side reports on particular vegetables. The reports include information on sales of particular types of vegetables, with breakdowns of this information according to the demographics of the buyers and the stores where the sales were made.
- **Freshlogic Market Reports:** These contain information on sales and consumption of vegetables with detailed information on the way vegetables are used by consumers.
- **Vegetables Australia and Vegenotes:** These are publications by AUSVEG containing articles of general interest to the vegetable industry. These publications feature data from various other sources but do not give any new data that is not available elsewhere.

Most of the research and development documents in this part of the website are publications of outside agencies and consultants. The data presented in these documents is usually a mixture of data sourced directly from the relevant consulting agency and data sources from government agencies such as the ABS. Data source information in these documents is mostly of sufficient detail to allow the reader to identify the source of the data. Most documents identify the source agency and survey from which they were taken.[8]

[5] For example, see http://ausveg.businesscatalyst.com/resources/statistics/vegetable-spotlight/beans.htm
[6] For example, see http://ausveg.com.au/statistics/BusinessDistributionbyValueofOperations-CurrentData.pdf
[7] For example, see http://ausveg.businesscatalyst.com/statistics/VegetablesGrownForSeed.pdf?1
[8] For example, see http://ausveg.businesscatalyst.com/intranet/vegetable-market/nielsen/nielsen.htm

2.2. Breakdown of vegetable categories

Since the data available on the AUSVEG website is sourced from different agencies there is no single standard categorisation for vegetables. Companies such as Freshlogic and Nielsen who undertake sales analysis of vegetables group these into 4 main categories with 26 subcategories as shown below in Figure 2.1. This is a consumer-based categorisation; according to Freshlogic, "[t]he categorisation rationale is driven by the inclusions of like product that consumers will trade off and products that are consumed together."[9]

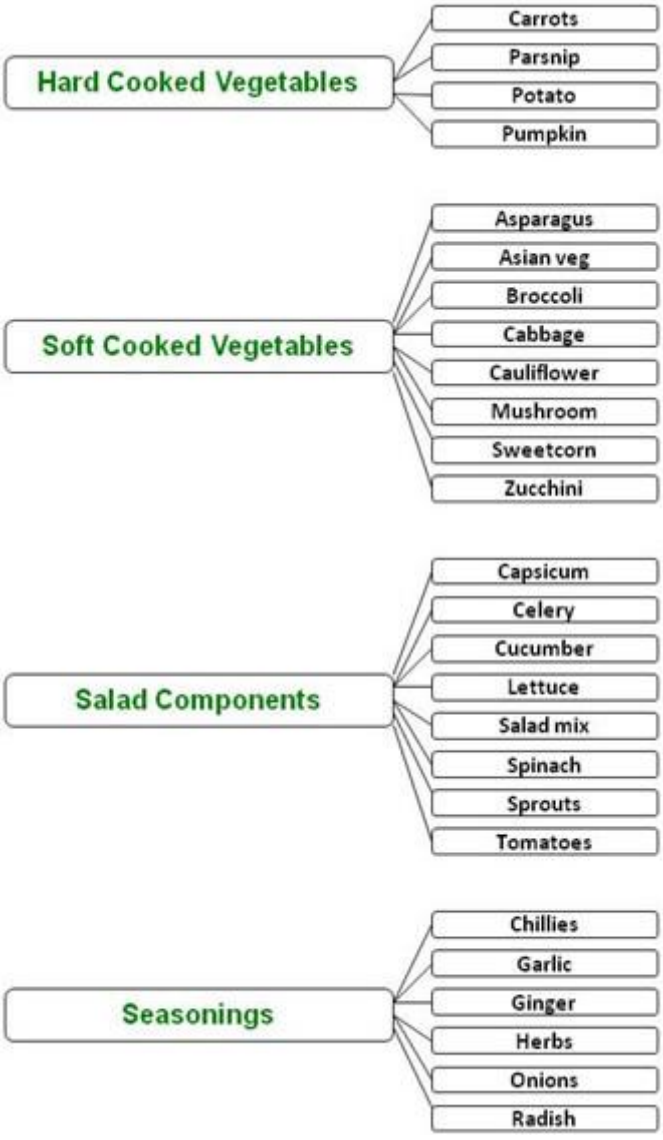

Figure 2.1: Breakdown of vegetable categories in Freshlogic reports[10]

[9] Freshlogic • *Veginsights* • *The Market - Q2, 2011* • August 2011, p. 23.
http://ausveg.com.au/intranet/vegetable-market/market-trends/themarket.htm
[10] Ibid, p. 23.

Data sourced from the ABS and ABARES use different categorisation systems which are less detailed than the one contained in the market reports and also exclude several categories of vegetables. For some aggregated data the ABS-sourced data separates vegetable growing into indoor and outdoor growing (with mushroom growing as a separate category). Breakdowns of vegetables for human consumption in the ABS data separate vegetables into 16 categories as shown below in Figure 2.2. Breakdowns of vegetables in the ABARES data separate vegetables into 12 categories as shown below in Figure 2.3.

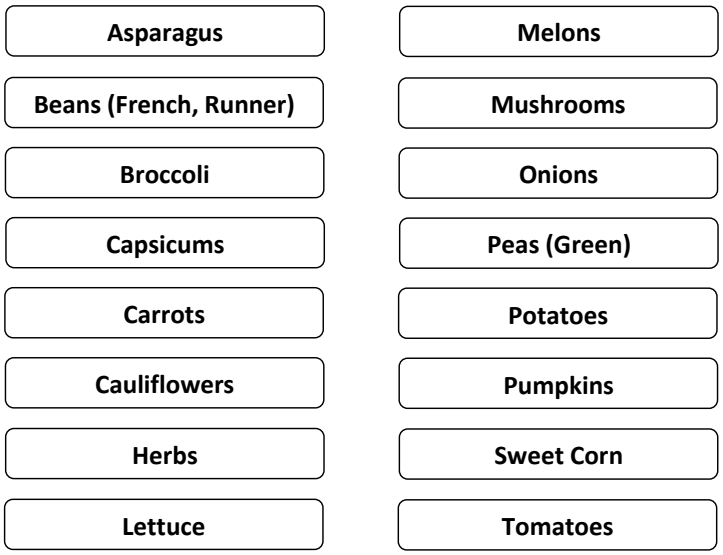

Figure 2.2: Breakdown of vegetable categories in ABS reports[11]

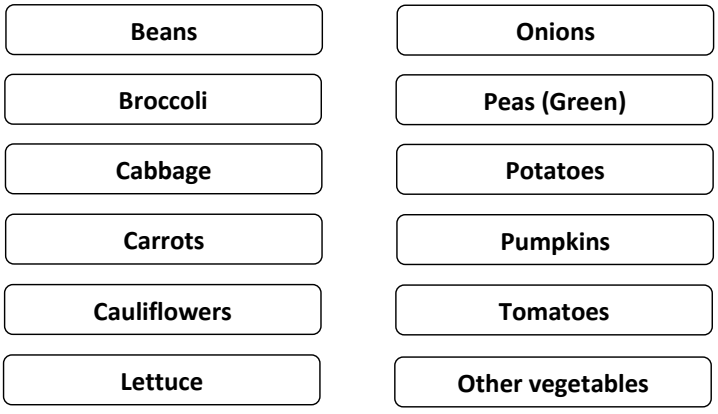

Figure 2.3: Breakdown of vegetable categories in ABARES reports[12]

[11] ABS • *Agricultural Commodities* • 7121.0 • 2010-11, pp. 24-25.
[12] ABARES • *Australian Vegetable Growing Farms: An Economic Survey 2009-10* • November 2011, pp. 9-10.

2.3. Other information held by AUSVEG

AUSVEG hold a large repository of research papers including documents that can be accessed on their website. These research papers include those produced under funding from the National Vegetable Levy and cover a large number of topics of interest to vegetable growers. AUSVEG have commissioned a Strategic Investment Plan for the vegetable industry which was produced by Consulting and Information Services (CIS).[13] This plan is based mostly upon data from various ABS and ABARES reports as well as an industry report from IBISWorld.[14]

As part of its representative operations AUSVEG is in regular contact with vegetable growers and receives a large amount of informal information from growers about the state of various vegetable growing businesses and industry trends. In briefings on this project AUSVEG have reported occasions where data from various sources has conflicted with reports provided by growers or other sources of information. This is reported to have occurred on a regular basis. Unfortunately AUSVEG have not kept any record of these instances and were unable to recount details of any specific instances where this occurred in sufficient detail for the present consultant to investigate the matter. In order to assist in any future review of data sourcing practices it would be useful if AUSVEG would keep a record of instances in which this occurs, so that they can recount examples of this nature in more detail when this is useful.

> **Recommendation 1:** To the extent practicable, AUSVEG should keep a record of instances in which published data it uses conflicts with other information sources (even in cases where this is merely anecdotal evidence from growers). This record should set out instances in which staff at AUSVEG have reason to believe that reported data may be inaccurate or flawed. This record should include instances where this occurs, details of the data source under consideration, and details of the conflicting evidence (even if this is only an anecdotal report). If it is not practicable to record all such instances then AUSVEG should attempt to record any instances that lead them to major concerns about the quality of reported data.

[13] CIS • *Australian vegetable industry Strategic Investment Plan* • VG10115
[14] IBISWorld • *Vegetable Growing in Australia* • Industry Report A0113 • May 2012.

3. Data needs of Australian vegetable growers

From its interactions with growers, AUSVEG presently has only anecdotal evidence on the data needs of Australian vegetable growers. In this report we supplement this with some statistical information taken from a small survey of growers. This survey was designed to get a basic idea of the data needs of growers that could be contacted through the AUSVEG contact list. Since time and budget for the survey were extremely limited this was done using an online survey.[15] The short time constraint for the project meant that it was not possible to conduct focus-group analysis prior to the development of the questions, nor to conduct a pilot survey. (This survey could itself be used as a pilot survey for a later survey if this is of value.)

This survey was undertaken as a joint effort by AUSVEG and the present consultant. There was only a small budget for the survey which did not allow for large-scale telephone or face-to-face interviewing. In order to control costs and get results within the time period for the project the bulk of the survey was administered by an email to growers linking them to an online internet survey. This was augmented by a fax survey for those growers who only have a fax contact with AUSVEG. (Both surveys used the same questions and answer choices.) In order to provide inducement for participants to respond to the survey AUSVEG offered a small prize to a random survey respondent.

3.1. Survey of vegetable growers

The **sampling frame** for this survey was the AUSVEG list of grower contacts. This list contains contact details for 3175 people or organisations (2960 by email, 215 by fax). Not all of these contact details are known with certainty to belong to Australian growers. To deal with this the survey contained preliminary questions to determine eligibility for the survey. Most of the contact details include an email address, which meant that most of the participants contacted were known to have access to a computer and internet facilities, and were able to conduct the online survey. For those that did not have a listed email address a hardcopy survey form was sent by fax instead.

[15] Online surveys have several advantages to recommend them in cases such as this. They are cheap to run and allow the surveyor to contact a large number of participants at low cost. In fact, given a sampling frame containing email contact details it is easy to conduct a complete census of this sampling frame, though the response rate will be low. The online facility also gives convenience for respondents, since it does not require them to fill out forms or post material to the surveyor.

The degree to which this sampling frame approximates the desired population of all vegetable growers in Australia depends on the accuracy and completeness of the AUSVEG contact list. AUSVEG have advised that they do not have an accurate list of all vegetable growers in Australia and do not have knowledge of the exact size of this population. (Comparison with business counts from government data suggests that the contact list is incomplete.)

The survey was sent out to all growers on the AUSVEG contact list. There were 120 eligible respondents to the survey. The response rate was low (3.8%) which is normal for a commercial survey administered by email/online participation; indeed, this is the main drawback of online surveying. This means that the results of the survey should be read with caution, as the respondent population may differ from the overall population of growers. (First of all, the respondents may differ systematically from the sampling frame, and secondly the sampling frame may differ systematically from the population of all growers.). Despite the low overall response rate, response among large growers was far higher than for small growers, as is shown in the data analysis section below.

Another caveat should be noted with regard to this type of survey. Since the survey involves questions about data needs and the usefulness of particular types of data, the responses are necessarily self-reported and cannot be corroborated by any more objective method. In such cases it is important to bear in mind that answers to survey questions may differ from actual behaviour. This can be the case in surveys when answers are "aspirational," meaning that the respondents may answer based on what they think they should do, rather than what they would actually do. (For example, if asked what kind of data they would like to have for their business, a grower might list all sorts of data types that they think they *should* use, when actually, they wouldn't really have the time or patience to use this data even if they had it.) It is not possible to assess the degree to which this might occur, but it should be regarded as a caveat to the results of the survey.

Details of all questions in the survey and other methodological details are found in Appendix A. This Appendix also sets out count data and related statistics from the raw data set, but does not contain the raw data. The full data set (with contact details of growers omitted) was provided to AUSVEG by the consultant as part of this project and the data presented in this report can be verified directly from that source. The data section below sets out relevant data for the non-administrative questions of the survey. The responses to key questions are shown below in Figures 3.1-3.8. Exact count data for these figures can be found in tables in Appendix A.

3.2. Data from the survey

The survey was emailed and faxed to people on the AUSVEG grower list on 1 November 2012 and a reminder notice was sent by email on 9 November 2012. The survey was closed at the end of 12 November 2012 at which time there were 137 total respondents (123 online, 14 fax). Of the total respondents to the survey there were 120 that were eligible for participation (106 online, 14 fax). There were 17 ineligible respondents that participated in the online survey; these respondents were removed from the data set for the purposes of analysis.[16]

(Note: For presentation purposes the wording of questions and answers has been modified to make them more succinct in the graphs of results presented below. These modifications make the presentation of results more concise but preserve the essence of the questions and answers. For exact wording of questions and answers see the full survey in Annexure A.)

Awareness of AUSVEG statistical information: Of the 111 eligible respondents who answered Question 3 of the survey, 75 of these (67.6%) indicated that they were aware of the 'Industry Statistics' on the AUSVEG website. Access to these statistics by this group was determined by Question 4 of the survey, with the results from this group shown below in Figure 3.1.

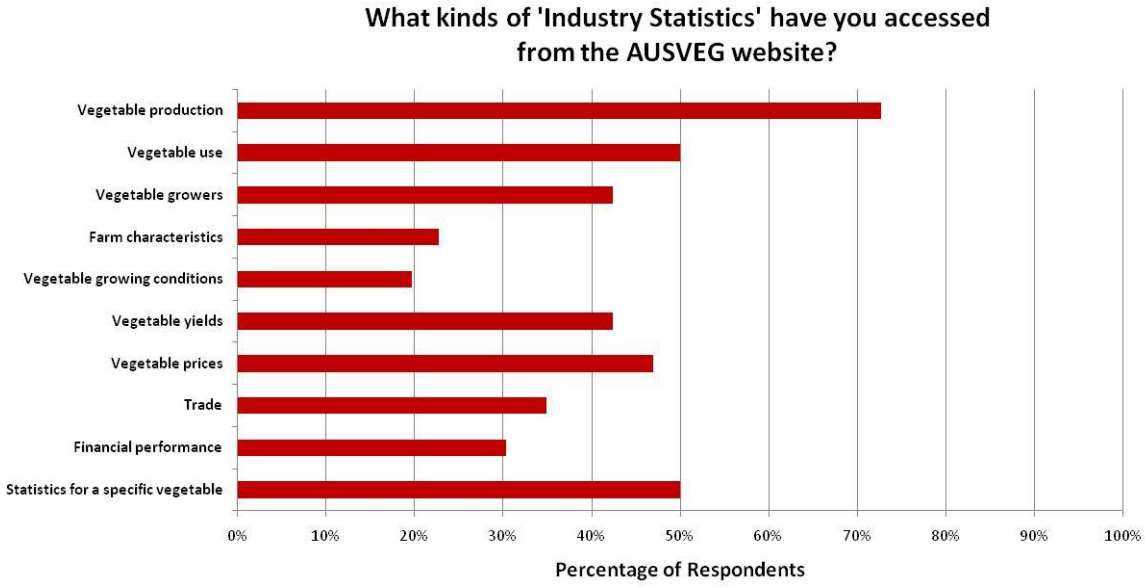

Figure 3.1: Industry Statistics accessed from AUSVEG website (categories)

[16] In some cases the qualification questions were not fully answered by the respondent. In these cases the respondent was only disqualified from the survey if the answers given revealed a disqualifying factor.

Of the 75 eligible respondents who were aware of the statistics on the AUSVEG website, 66 of these had accessed one or more categories of statistics on the site. The number of categories accessed by each of these respondents is shown below in Figure 3.2. This shows that users tended to access a few categories of information, with some users accessing all categories. (Those users that accessed all categories of statistics tended to be larger growers. In particular, there were 5 growers who reported having accessed all the categories of information. These were all large growers, in that they either reported high EVAO or, if this was unreported, they described their business as a "large company".)

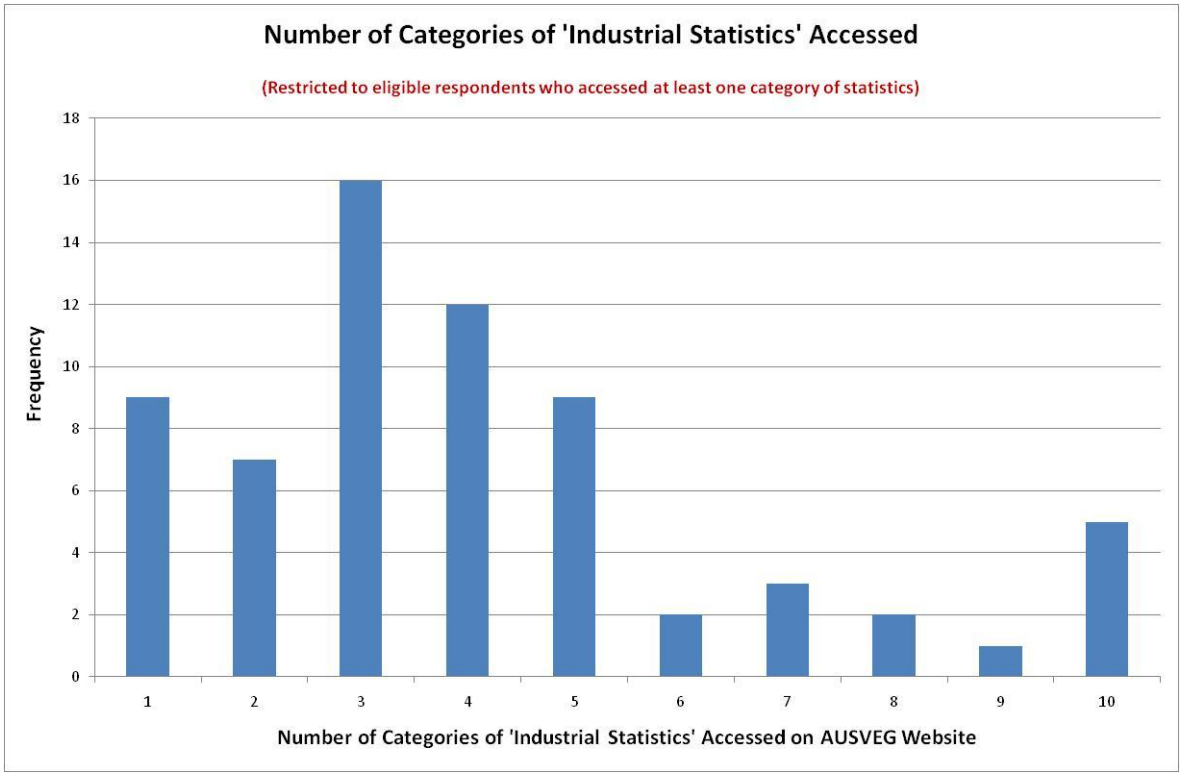

Figure 3.2: Industry Statistics accessed from AUSVEG website (counts)

As would be expected from the fact of access across multiple categories, access to different kinds of statistics was positively correlated between the various pairs of categories. Estimates of the pairwise correlations showed that there was moderate to strong correlation between access to each of the different pairs of categories, with estimated correlation coefficients ranging between 0.39 to 0.73 (see Table A.4 in Appendix A for details of pairwise correlation). This indicates that users tended to access multiple kinds of statistics. Highest correlation was between access to information regarding vegetable production and vegetable use.

Types of data that are useful to your business: Of the 98 eligible respondents who answered Question 8 of the survey, 31 of these (31.6%) indicated that they were only interested in data pertaining to types of vegetables grown in their own business and the remaining 67 (68.4%) indicated that they were interested in data pertaining to all types of vegetables. Information on the usefulness of particular types of data were determined by Questions 5-6 of the survey, with the results from this group shown below in Figure 3.3. (Results are ranked by the proportion of respondents reporting the category as "very useful".)

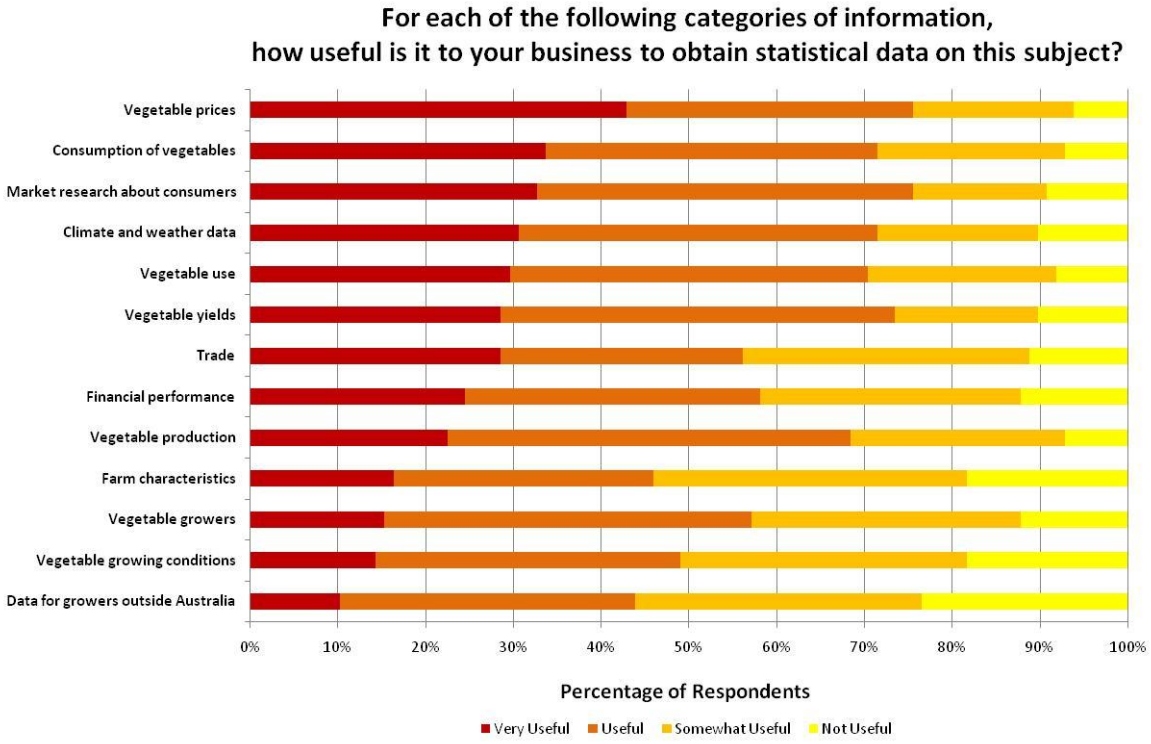

Figure 3.3: Usefulness of various kinds of statistical data

In Question 7 respondents were given the opportunity to set out further kinds of statistical data that would be useful to their business in an open-ended format. These open ended responses are set out in Table A.6 in Appendix A and are categorised by subject. The responses were quite varied and some were quite specific to the concerns of particular growers. However, several respondents indicated that they would like a more detailed breakdown of vegetable categories in the data. Several growers also indicated a desire for additional pricing information, including accurate wholesale and retail prices. Some were interested in "real-time" prices at markets. Other desirable types of data mentioned were data on biosecurity, CO_2 usage, market and consumption data, and information on farming practices and import tariffs for overseas growing operations.

Data characteristics that are important to your business: Of the 96 eligible respondents who answered Question 9 of the survey, 89 of them identified data accuracy as being either important or very important. Information on the importance of various data characteristics and the use of data in business are shown below in Figure 3.4.

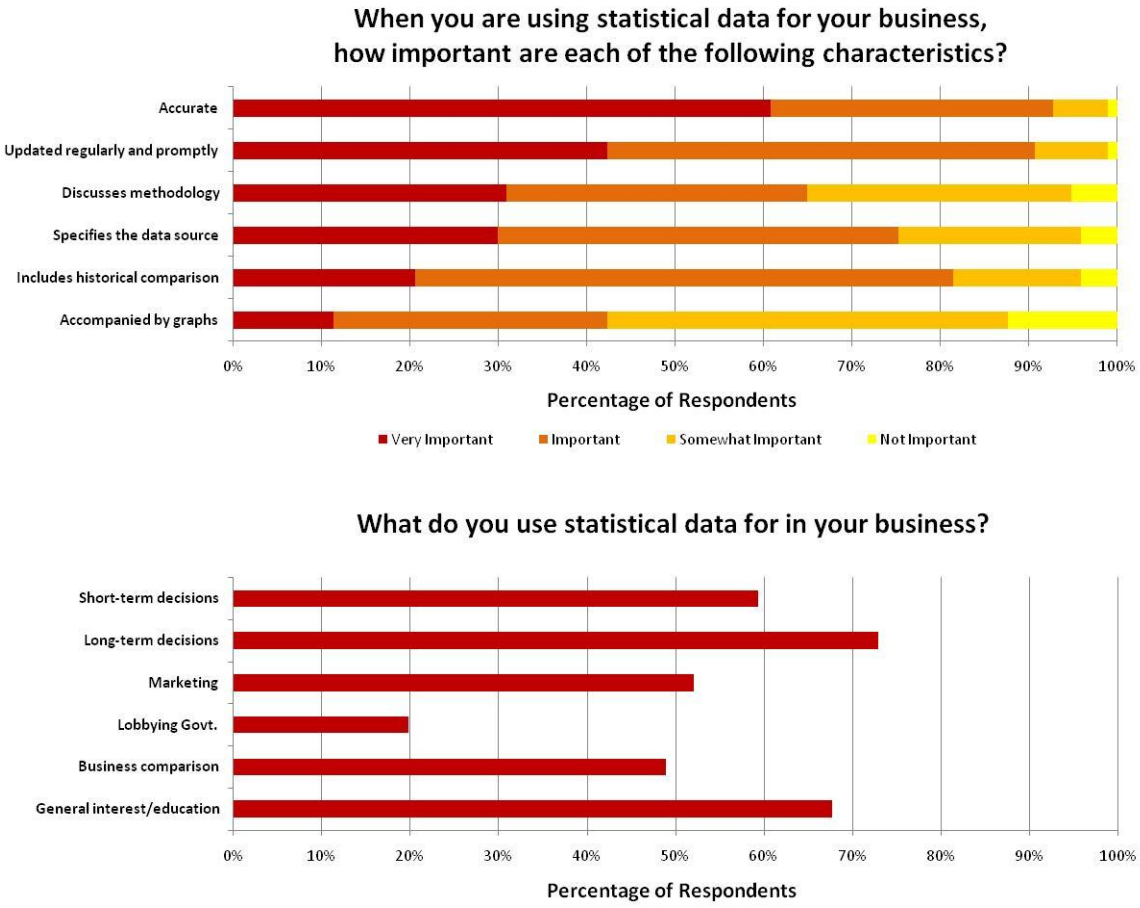

Figure 3.4: (a) Importance of various data characteristics
(b) Use of data in business

(Question 9 of the survey intentionally asked growers to rate the importance of data accuracy as a characteristic. Since lack of accuracy renders data inherently unhelpful, an indication by a grower that this characteristic is not important might be taken to mean that statistical data itself is not important to the business of this respondent. In fact, there was only one respondent who indicated that accuracy in reported data was not important as a characteristic. This respondent also indicated that only market research and consumption data were "somewhat useful" to his business, with all other categories of data being "not useful". Finally, he also indicated that he uses statistical data solely for general interest/education. This would seem to confirm that this answer is indicative of a lack of interest in statistical data for business decisions.)

The responses on data usefulness and importance of data characteristics all have positive rank-correlation, meaning that a large measure in one (more usefulness or importance) tended to go with a large measure in others (more usefulness or importance). This was due to the fact that respondents tended to report importance or usefulness measures "across the board" for the various characteristics of data. Among the various characteristics, data accuracy and regular and prompt updating of data were ranked as having the most importance. These were also found to have moderately strong rank-correlation (0.59) among the respondents, meaning that respondents tended to rank both of these characteristics similarly.

(A full list of rank-correlations between responses to the questions featured in Figures 3.3 and 3.4(a) is set out in Appendix A.9. The overall patterns in the graphs do not change substantially when we remove respondents who indicated that accuracy of data was either unimportant or only somewhat important. This occurs because the rank-correlation between the accuracy importance outcome and the other outcomes were mostly quite low.)

Characteristics of your business: There were 94 eligible respondents who reported the number of vegetables produced by their business and 77 who estimated the value of output. Information on the number of vegetables grown by respondents is shown below in Figure 3.5.

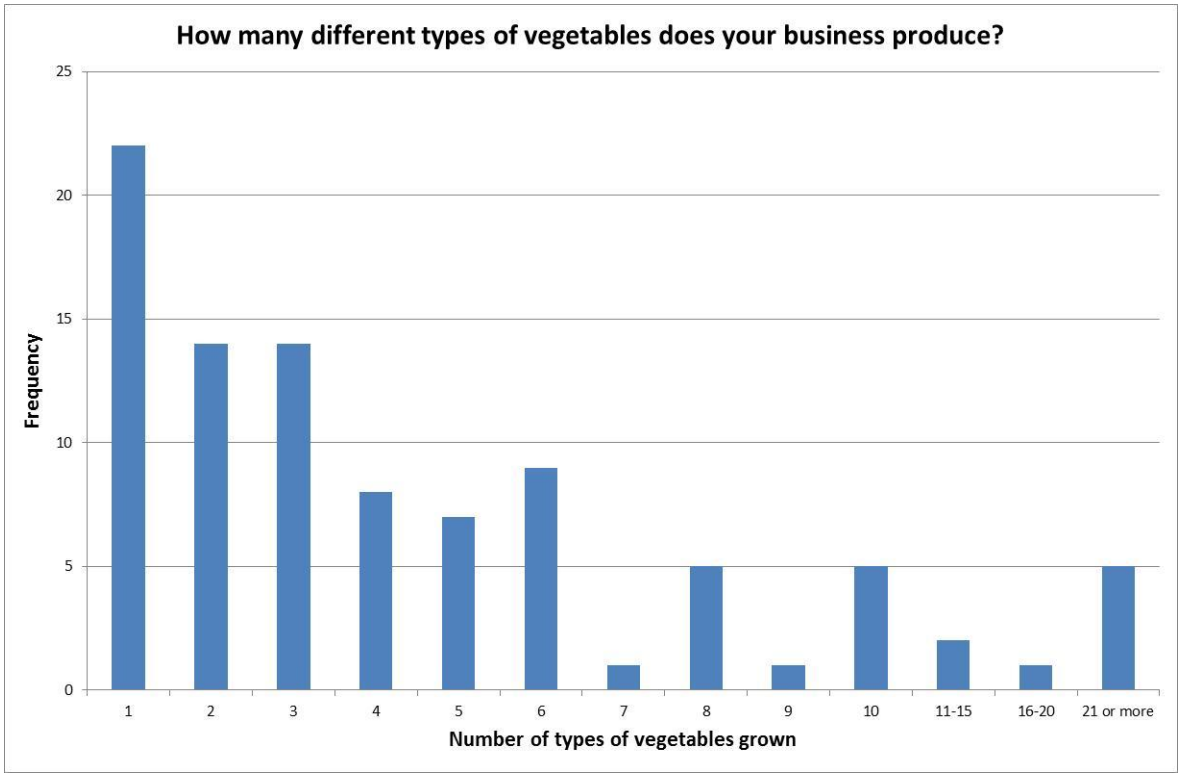

Figure 3.5: Number of types of vegetables grown

Question 12 of the survey solicited information from respondents regarding their Estimated Value of Agricultural Output (EVAO). These EVAO responses were categorised similarly to government data sources for comparative purposes, but with finer categories. There were 77 respondents who gave estimates for this question. The reported EVAO values are shown below in Figure 3.6. (Note that this is a bar graph of the data; the categories on the horizontal axis have differing lengths and have not been scaled to obtain a proper histogram.)

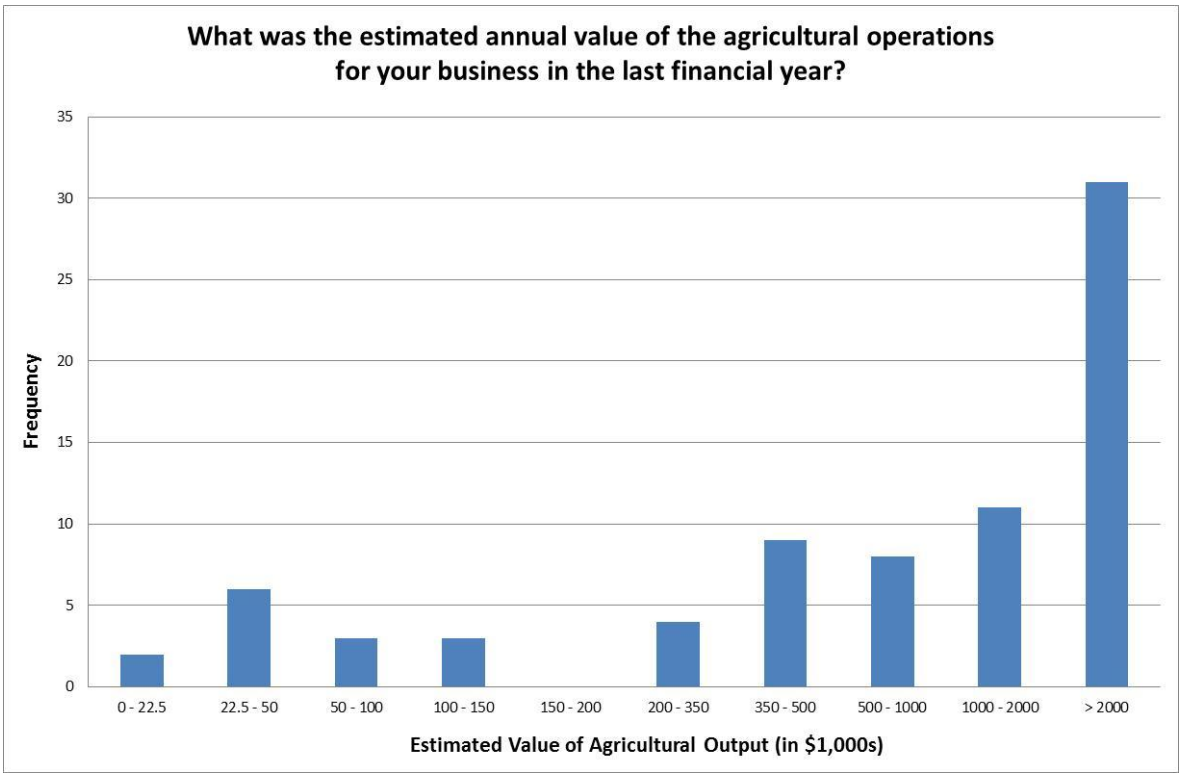

Figure 3.6: Estimated Value of Agricultural Operations (EVAO)

The raw frequency data for this question shows a large number of businesses with high EVAO values. The conjunction of this survey information with information from government statistics allows us to see the degree to which the respondent population in the survey is representative of the overall population of vegetable growing businesses in Australia (as reported in various government statistics). To examine this we can compare the counts of respondents in the survey with the business counts by EVAO category in comparative statistics. These are taken from data from the ABS. This allows us to determine the percentage of businesses in each EVAO category counted by the ABS which responded to the survey, which in turn allows us to see how the survey respondents compare to the population of vegetable growers estimated by the ABS. The representation of growers in the survey from each of the reported EVAO categories is shown below in Figure 3.7.

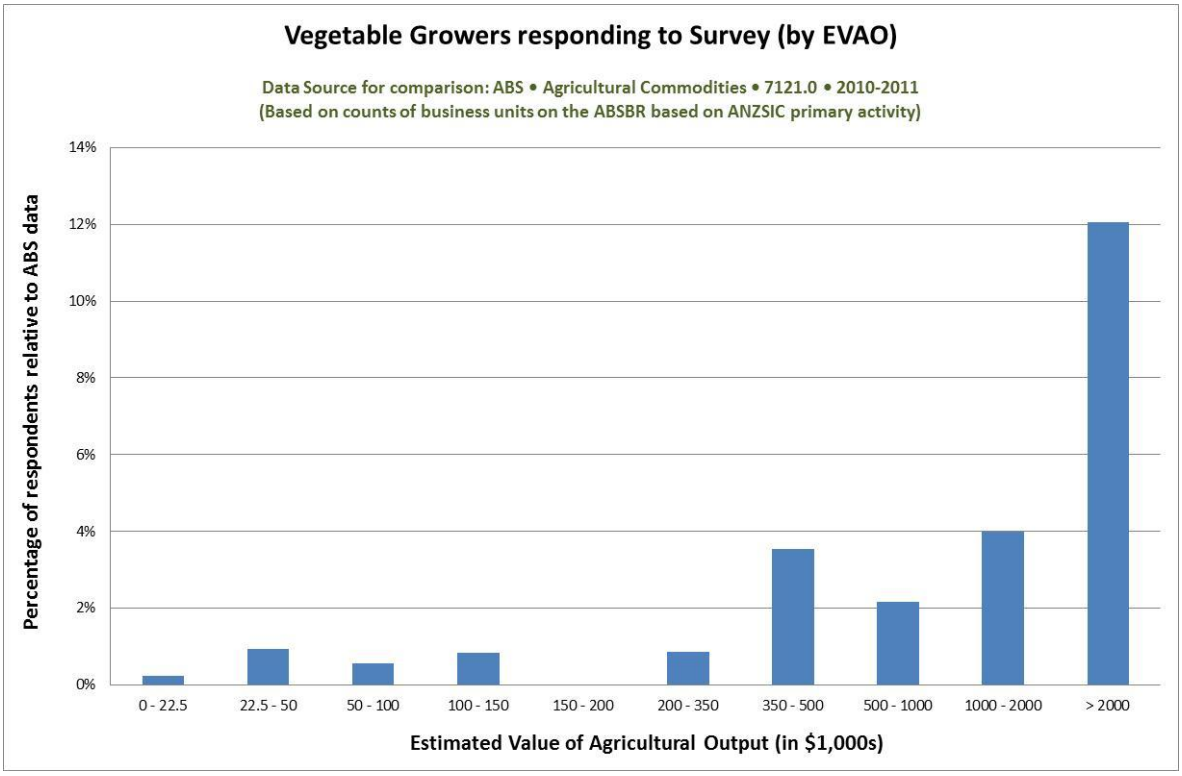

Figure 3.7: Percentage of growers responding to survey, relative to ABS data

The above figure shows that the respondents to the survey (those who answered Question 12) included a much larger preponderance of larger growers than is reported in government data examined in subsequent sections of the report. This is most likely due to greater propensity-to-respond to the survey among larger growers, though it may also be due, in part, to a larger representation of larger growers in the AUSVEG contact list.

The relative preponderance of larger growers in the survey means that the responses in the survey mostly represent the data needs of larger growers. As previously noted, these growers tended to have used more categories of statistical information at the AUSVEG website, which is in line with the hypothesis that larger growers are more sophisticated in their data use. Relative to smaller growers, large growers were less interested in data on prices, weather and growing conditions but more interested in all other types of data including production and consumption data. Large growers were also more interested in data accuracy, methodology and historical comparison of present data with past data than smaller growers. The greater interest in historical comparison stuck out as a major difference between larger growers compared to smaller growers – several larger growers responded with an interest in this data characteristic.

Since the survey respondents were mostly larger businesses, we present some basic data on the relationship between business size (measured by EVAO) and data needs. For those respondents that reported their EVAO, the correlation between this reported value and the usefulness and importance responses in Questions 5, 6 and 9 are shown below in Figures 3.8(a) and (b). The correlation coefficient shown in the figures is a rank-based measure using the ordinal responses to the questions on the usefulness of different types of data and the importance of different data characteristics. (Note that a blue bar shows positive correlation and a red bar shows negative correlation. All correlation values occur on a scale from negative-one to positive-one.)

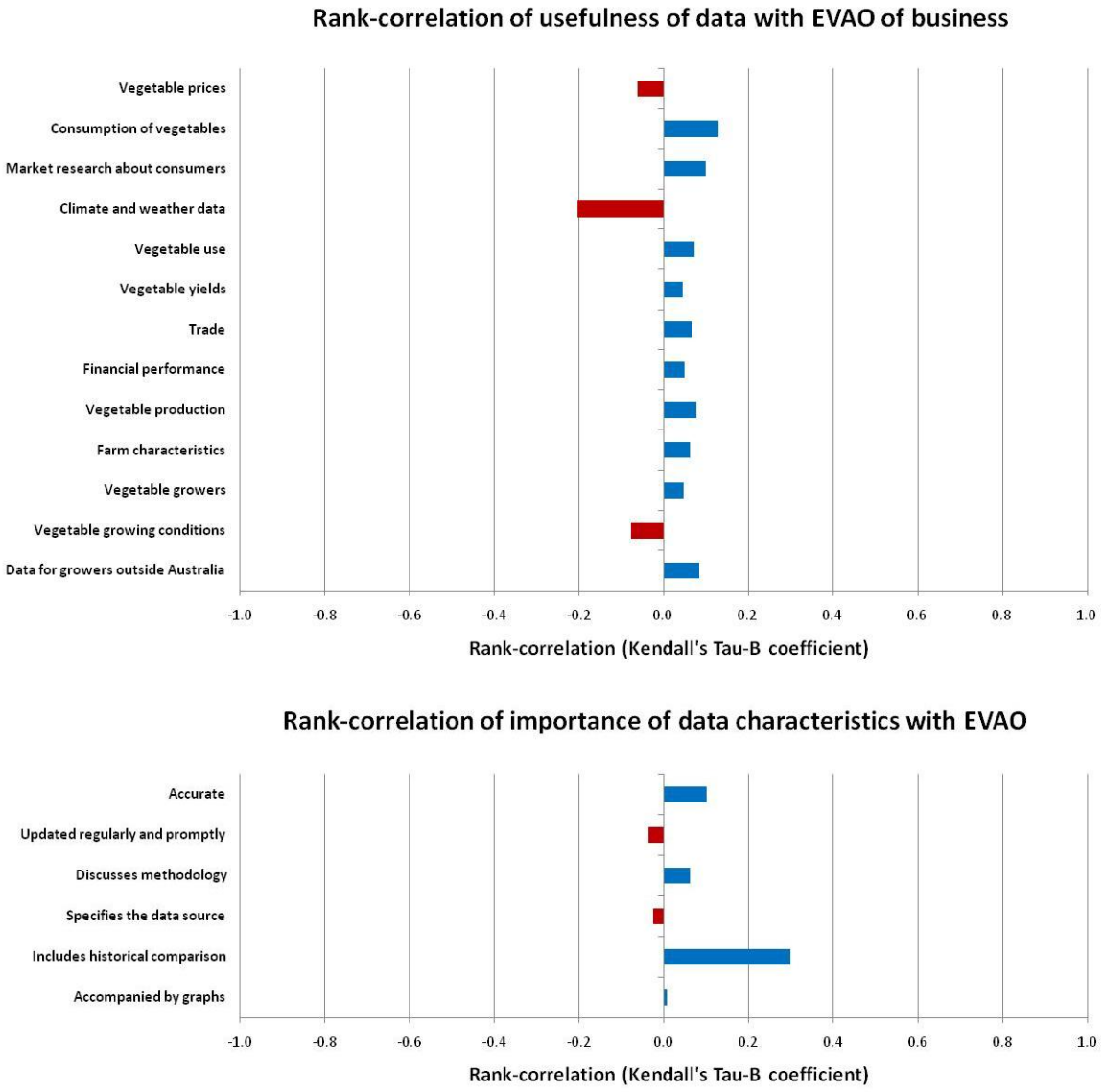

Figure 3.8: (a) Correlations of EVAO with reported usefulness of data types
(b) Correlations of EVAO with reported importance of data characteristics

3.3. Reweighting responses using EVAO

The raw data from the survey of growers shows a preponderance of larger growers relative to the size of this population in the ABS data. (We examine this data source in detail in the next chapter.) This means that the responses of larger growers are overrepresented in the raw data relative to their estimated population size. The preceding data outcomes must be read with this in mind, so that it most accurately represents data on growers of the type that responded to the survey —namely, growers with a large reported EVAO relative to the norm in the industry.

In order to try to correct for this biasing effect in the sample it is possible to use a technique to weight the responses in the survey in order to ensure that each EVAO group represented among the respondents contributes an overall weight that is proportional to its estimated size in the population. Estimates of the latter can be taken from ABS data which we will discuss in detail in the next section of this report.) This kind of reweighting of the data has the effect of adjusting the outcomes in the survey data to give an unbiased estimate of the responses that one would expect from the entire population of growers in the ABS data. This estimate is unbiased only in the sense that it filters out the biasing effect introduced by the unrepresentative breakdown of EVAO among the respondents.

Since larger growers are overrepresented in the present survey data this weighting procedure involves scaling up the weight of responses from growers with low reported EVAO and scaling down the responses from growers with high reported EVAO.[17] This rescaling means that smaller growers have their responses amplified and larger growers have their responses diminished, to an extent that leads the total weight for each group to be proportional to its size in the estimates produced by the ABS.

Although the scaled output measures are useful in getting an unbiased estimate of the likely responses in the entire population of growers, one major drawback of this scaling technique in the present case is that very high weight is given to a small number of responses from small growers and this introduces greater propensity for large sampling errors in the responses. For

[17] Responses from growers who declined to report their EVAO were not scaled up or down and instead maintain their regular weighting in the output. It is possible to conduct a more sophisticated analysis in which EVAO is imputed to these growers on the basis of a regression analysis using the other variables. This recognises that EVAO may be related to propensity-to-respond for this question. Time constraints for the present project meant that we conducted the simpler analysis in which these respondents kept their initial weighting. Since the number of respondents in this category was not too large, this analysis should suffice to give a reasonable picture of the rescaled outcomes.

the present survey data there were only two respondents in the lowest category and these were each given a weighting 8.56 times the regular weighting for responses; there were thirty-one responses in the highest EVAO category and these were each given a weighting of 0.17. (Full list of applied weightings can be found in Table B.1 in Appendix B.) This means that the results of this scaled analysis must be **read with extreme caution**, bearing in mind the potential for large sampling error. With this caveat in mind we present rescaled outputs for the previous statistics to see how this adjustment affects the estimates of responses.

Scaled and unscaled data for access to AUSVEG 'Industry Statistics' is shown below in Figure 3.9. (Full details of the scaled statistics can be found in Table B.2 in Appendix B.) Comparison of the scaled measures in these figures with the unscaled raw data shows that there is a slight effect due to the reweighting being applied but the same overriding pattern obtains. There is an evident decline in access levels for most categories of statistics with slightly higher access to statistics on vegetable production and statistics for specific vegetables. This overall decline in access is due to the fact that greater weight is now being applied to small growers who tended to access less statistics at the AUSVEG website. In particular, the large growers that accessed all statistics at the site have had their weighting reduced substantially. The ranking of the categories by access level remains similar (though not identical) after the application of rescaling though there is a substantial reduction in access levels for data on vegetable use, farm characteristics, growing conditions and trade.

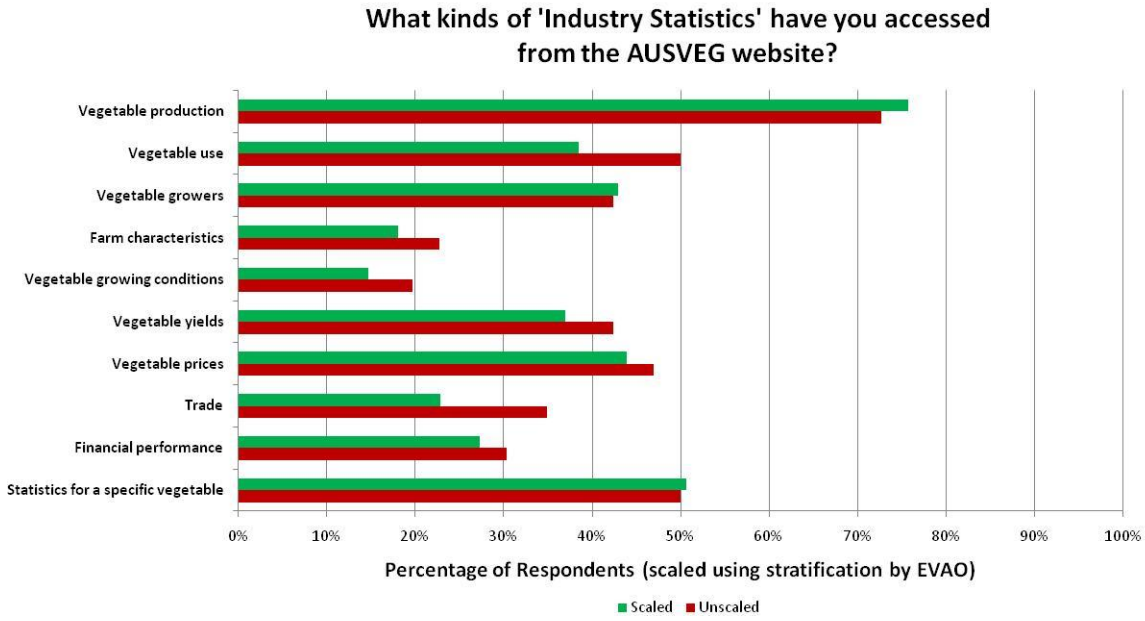

Figure 3.9: Industry Statistics accessed from AUSVEG website (categories) (scaled by EVAO)

Scaled and unscaled data for counts of the categories of AUSVEG 'Industry Statistics' accessed is shown below in Figure 3.10. This gives the counts of categories for both the scaled and unscaled data to give a picture of the variety of access to these statistics by growers. (Full details of the scaled statistics can also be found in Table B.2 in Appendix B.)

On the count histogram the result of scaling is similar the result in the category-based graph shown above. There is again evidence of an overall decline in the number of categories of statistical data accessed, especially at the higher end of the histogram. There is now a clear hump-shaped distribution of counts at the lower end of the scale with the majority of growers accessing between 1-5 categories of information. The peak access count is still 3 categories, but there is a more recognisable hump shape around this mode.

The estimated number of growers accessing all categories of information has declined to less than half of the unscaled value, reflecting the fact that this higher level of access was among larger growers. The tail of the distribution is now quite small, reflecting the fact that most growers are estimated to access a relatively small number of categories of information. This is again due to the reduction in weighting of large growers who accessed either all, or a large number of categories of information.

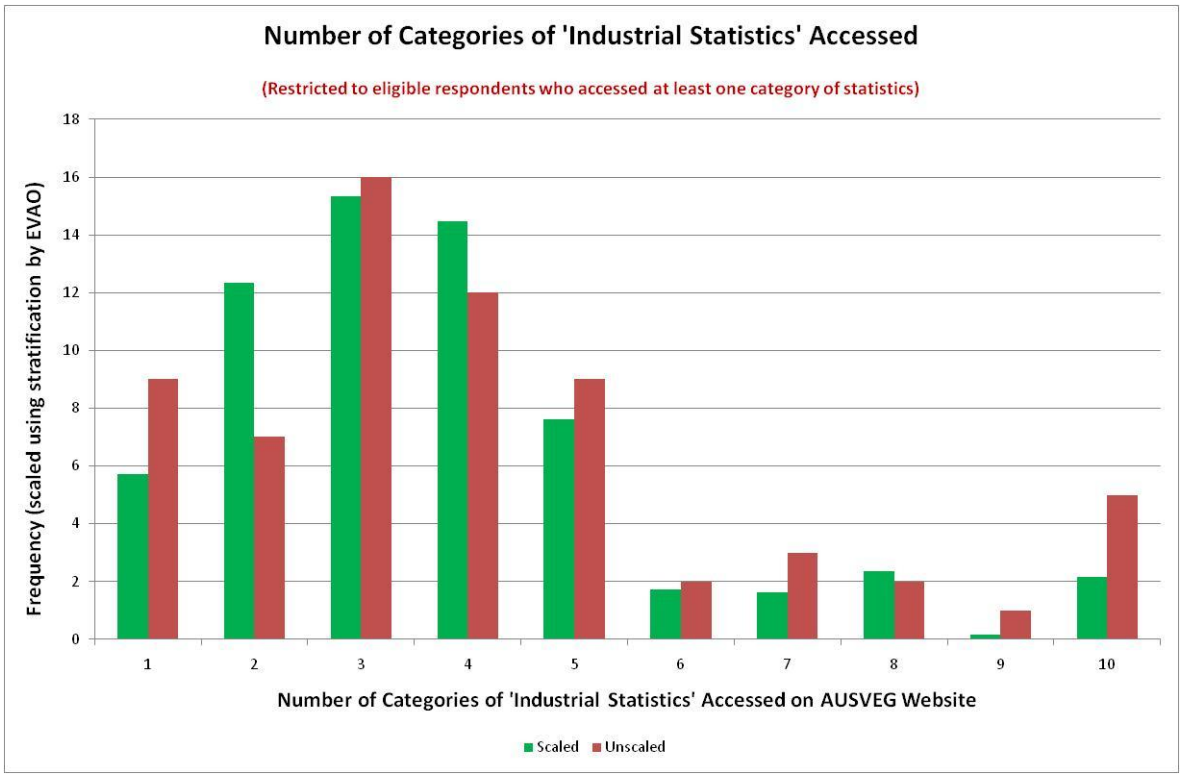

Figure 3.10: Industry Statistics accessed from AUSVEG website (counts) (scaled by EVAO)

Scaled data for the usefulness of categories of statistical information is shown below in Figure 3.11. This gives the scaled percentages of usefulness ratings for each category of statistical data to give a picture of the usefulness of data categories to growers. (Full details of the scaled statistics can also be found in Table B.4 in Appendix B.) The ordering of categories is kept in accordance with Figure 3.3 for comparative purposes. This means that the ordering in the graph is based on rankings in the raw data.

Comparison of this graph with Figure 3.3 shows that there is an overall reduction in reports of data usefulness. The ranking of the categories remains similar to the unscaled data though there is a clear increase in reported usefulness for climate and weather data. This is consistent with the previous finding of a weak to moderate negative correlation between usefulness of this category of information and the EVAO measure (i.e., since we have scaled up the weighting of smaller growers, this has increased the reported interest in this category due to the correlation in these measures). The scaling also has the effect of improving the relative reported usefulness of trade data (relative to the other categories of data) but not its absolute measures of reported usefulness. (In other words, its reported usefulness has not gone up, but it has not gone down as much as the other categories of data around it.) After the scaling there is now a more evident reporting of usefulness for vegetable prices and climate and weather data.

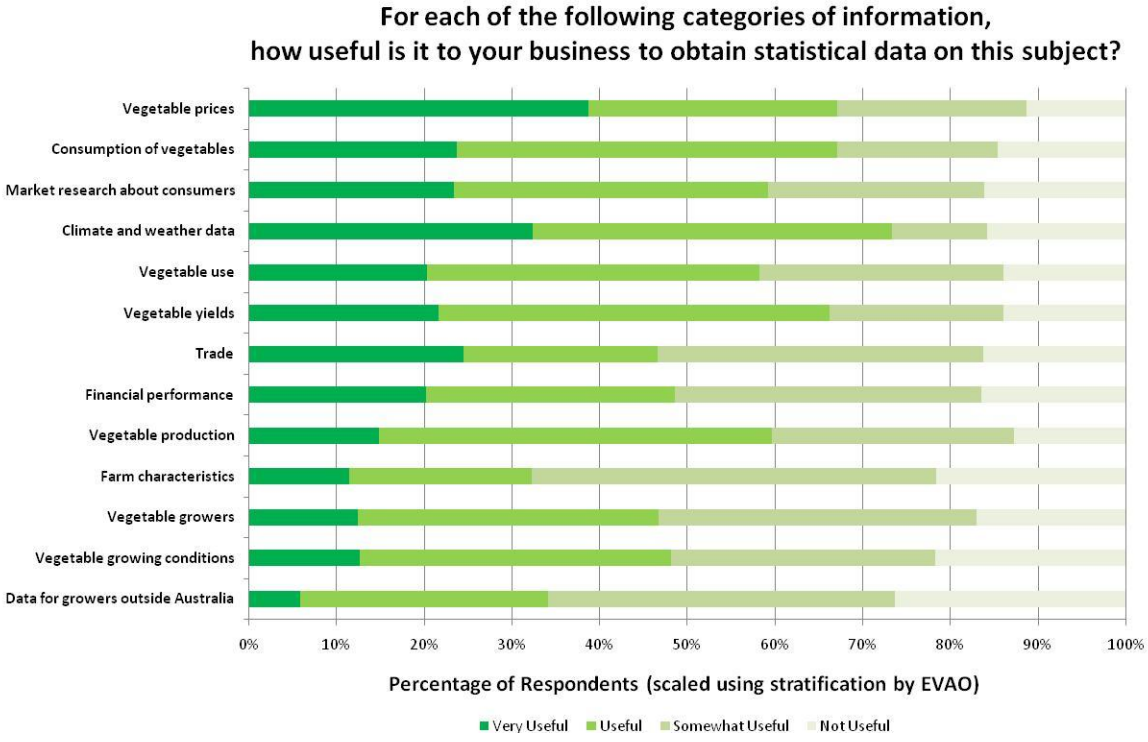

Figure 3.11: Usefulness of various kinds of statistical data (scaled by EVAO)

Scaled data for the importance of characteristics of statistical data and the uses of statistic data in business decisions are shown below in Figure 3.12. These graphs give the scaled percentages of importance ratings for each characteristic of data and usage reports in categories of uses. (Full details of the scaled statistics can also be found in Tables B.5 and B.3 in Appendix B.) The ordering of categories is kept in accordance with Figure 3.4 for comparative purposes. This means that the ordering in the upper graph is based on rankings in the raw data.

Comparison of Figure 3.12(a) and Figure 3.4(a) shows only a slight change in usefulness of characteristics. The estimates show high levels of importance for data accuracy and regular and prompt updating of data; these ratings are very similar to the ratings in the raw data. The order of importance remains similar, except that specification of the data source is now rated as more important than discussion of methodology. There is an evident decline in the usefulness of historical comparisons and no change in the usefulness of accompanying graphs.

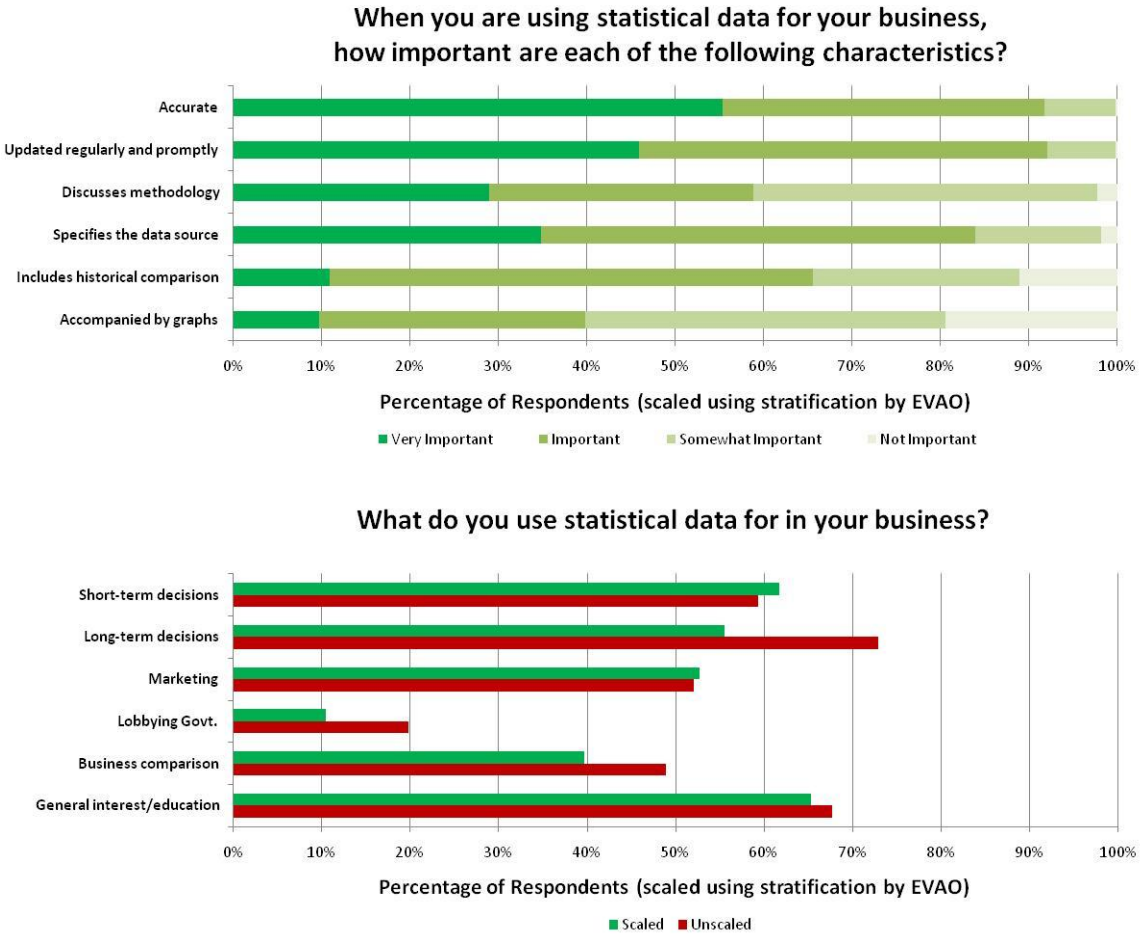

Figure 3.12: (a) Estimates of importance of various data characteristics (scaled by EVAO)
(b) Estimates of use of data in business (scaled by EVAO)

Looking at Figure 3.12(b) there is an evident decline in the estimated use of statistical data for long-term decision making, lobbying government and comparison/benchmarking with other businesses. This is again due to the fact that these uses of data were more prevalent among larger growers, so that the reduction in weighting to these growers reduces these measures. General interest/education is the most common use for statistical data in the scaled measures, reflecting the fact that this is a common use for smaller growers.

Although the reweighting undertaken here is substantial, the actual reweighted results bear a remarkable similarity to the raw data. This is mostly due to the fact that only weak correlations were exhibited between the EVAO measure and most of the statistical measures shown in the rescaled data. In cases where moderate correlations were observed in the raw data this has led to larger changes due to rescaling, as would be expected. The rescaled data gives an estimated picture of what the survey data might have looked like if the respondents had been distributed by EVAO in accordance to their distribution in the population of growers (as estimated by the ABS). This rescaled data suggests that there is less access to AUSVEG Industry Statistics than is suggested by the raw data with a clearer hump-shaped distribution of access counts with most growers accessing between 1-5 categories of information. There is less reported usefulness than in the raw data, but vegetable prices and climate and weather data emerge as the clear favourites in terms of estimated usefulness. The rescaled data echo the previous finding that accuracy and timeliness of data are most important to growers, but there is also a strong interest in specification of data sources and discussion of methodology. The rescaled data estimates that primary use of statistical data is for general interest/education purposes and that statistical data is more likely to be used for short-term decision making than long-term decision making, contrary to the raw data. There is also still substantial use of data for marketing and comparison/benchmarking with other businesses.

The results from the raw data and the scaled data give us a look at two different things. The raw data gives us a picture of the respondent group, including the fact that this group included a preponderance of larger growers relative to their numbers in the population of growers. This gives us an impression of opinions of growers as filtered through the survey responses. (This can be thought of implicitly as a weighted sample of the entire population of growers, using the unknown propensity-to-respond to the survey as the relevant weighting.) The scaled data give us a picture of the population of growers by rescaling to compensate for the overrepresentation of larger growers in the sample. This allows us to remove a source of bias in the data but it comes at the cost of increasing the likely size of sampling errors.

3.4. Follow-up with selected growers

After the receipt of data from the survey the present consultant conducted follow-up interviews with a small number of growers identified by AUSVEG to discuss their data needs. This was done to establish further information that could not be determined from the survey and to obtain any nuances in data needs that may not have come across in the online survey.

AUSVEG provided the present consultant with a list of contact details for 16 vegetable growers though contact information for one grower was no longer valid. Of the 15 growers with valid contact information, the consultant was able to arrange phone interviews with 11 of them. The remaining growers were not able to be contacted or were not able to give an interview within the timeframe for the project. Interviews were conducted by phone at times convenient to the grower being interviewed. The consultant asked the grower open-ended questions about their use of data, data needs of their business, their participation in ABS surveys, the characteristics of their business, and any other matters regarding data needs that the grower felt to be relevant. Overall results of these interviews are summarised below.

The small sample for these follow-up interviews and the non-randomised sampling method mean that the results of these interviews should be taken with caution. They represent the responses of a small number of growers identified by AUSVEG rather than a representative group chosen at random from the population of all growers. With this caveat in mind the results may still give some useful information which cannot be gleaned from the survey of growers.

Sources of data: None of the growers interviewed expressed interest in government statistics from the ABS or related government agencies. Several growers expressed the view that these statistics were either irrelevant to their business decisions or that they lacked accuracy or timeliness. Some said they look at ABS statistics for general education on the industry but none reported any business decisions that were affected by these sources of data. None of the growers reported any interest in aggregated data for the industry as a whole or any interest in data on foreign trade. Most growers tended to take an interest in more localised information.

The sources of data used depended on whether growers were operating under fixed supply contracts or were engaging in speculative growing. Several growers who produce vegetables without fixed supply contracts reported that they use market reports at their local vegetable markets to obtain price and sales information for vegetables. Those growers reported that they

use this information regularly to make planting, growing and harvesting decisions. One grower reported that she "needs this kind of data all the time". Conversely, other growers who sell most of their vegetables on fixed supply contracts did not have an interest in market reports.

Attitudes on these market reports were mixed. Some growers reported heavy reliance on them in their business decisions while others expressed scepticism at the accuracy of these reports. One grower reported his belief that market reports are manipulated by large sellers through inaccurate reporting and selective withholding of data. Another grower expressed his view that "ninety percent of the time they're bullshit". Another more-sympathetic grower reported that the reports are "correlated with" actual prices but do not reflect them with enough accuracy to warrant their use for business decisions. Some growers reported that they use data on technical matters such as pesticide effectiveness for their operations but do not use market data. Some also reported using weather reports to schedule their growing and harvesting activities to appropriate times. These growers reported that their growing and marketing decisions were determined by existing practices and that they used data purely for technical farming matters.

Extent of data use: Results on the extent of data use were mixed. Some growers reported that they do not use data for their business decisions at all, some reported narrow use of data for small parts of their business, while other reported that they use several types of data for different aspects of their business decisions. Several growers reported that they rely primarily on direct contact with other growers to determine the state of the industry. Even among growers who use statistical data, this was supplemented to a large extent by a network of contacts with other growers and industry participants. Among the growers interviewed, their data use depended to some extent on whether they felt they had a reliable source of required information through other growers, salespeople and other industry participants. Growers with reliable sources of information from these sources tended to rely less on statistical data.

Among the growers interviewed, their use of data depended on life circumstances and decisions about the foreseeable future of their business. Heavier users of statistical data tended to be younger growers with a longer foreseeable future in the industry. One grower reported that he used data heavily in the early years of his business when he was younger but then later relied more heavily on his own established practices. He also reported that his future use of data would depend on whether he passed the farm to his children or sold it to another farmer, which would in turn depend on his children's career decisions.

Several growers reported being short on time and relying on fast delivery of information for their business. A few growers mentioned use of facilities through email alerts, SMS messages or reports sent directly through other electronic devices to alert them to some new source of data or pieces of growing advice. Several growers expressed interest in receiving more data and reports through these kinds of mediums.

Types of data used: Several growers who do not have fixed supply contracts in place expressed the importance of timing growing decisions to fill market gaps for various vegetables. Some growers reported that they use supply and demand information from markets to try to target their vegetable growing activities to gaps in the market. They also reported using pricing data from market reports to decide what to grow and when to take crops to markets. One grower said that she does not harvest her crop unless the pricing data in market reports indicates that she will meet a minimum required price to "make it worth [her] while".

Some of the growers interviewed complained that other small growers tend to follow the prevailing growing trends rather than conducting their own analysis of how to fill market gaps. One grower reported that this can lead to situations where there is an oversupply of a particular vegetable and lower sale prices for growers as a result. The grower expressed considerable frustration about this and took the view that it is preferable to go against the popular vegetables — that once something is "the new big thing" everyone starts to grow it and you should switch to something else.

Unlike the speculative growers, growers on fixed contracts reported that they were not worried about pricing information and data on gaps in supply. This was due to the fact that their sales and prices were fixed by pre-existing contract terms. These growers were more interested in data on technical issues related to growing methods and conditions rather than price and sales information. Some of these growers reported using weather forecasts for scheduling decisions. Some also reported using data on pesticides and disease to make spraying decisions.

Growers did not report any specific types of data that they would like that is not presently available. However, some growers reported that existing data from the ABS and other agencies is not sufficiently finely categorised according to types of vegetables to be of use to them. One grower expressed a desire for finer categorisation of production data according to each specific type and subtype of vegetable (e.g., breakdown of data on lettuce into varieties such as iceberg lettuce, cos lettuce, etc.).

Participation in ABS, ABARES surveys: Almost all of the growers interviewed reported that they undertake regular participation in the ABS census/surveys of the agricultural industry, usually every year and often more than once per year. These growers reported spending significant amounts of time filling out survey forms and dealing with these surveys.

Growers were asked by the consultant about how much effort they put into providing accurate data for the ABS, and their attitude to these surveys. Reponses differed markedly between growers. Though most growers reported that they make an effort to give the most accurate information possible, a few growers reported that they either do not give the ABS the required information or that they do not take care to give accurate information. One grower reported giving the ABS "stuff all". The main reason reported for the refusal to give accurate information was a lack of trust in confidentiality of the surveys and the lack of time. Another grower reported that there was "no gratitude" for the information and another said that he was sick of being surveyed so often and that it was "a drain on [his] time". (This grower said that he still gives the ABS data as requested.) Another grower reported that she gives accurate information on aggregates but does not give the ABS information about matters of "fine detail". Growers who reported efforts to give accurate information to the ABS expressed the view that accuracy of this industry data is important to the vegetable industry. They tended to express views that suggested a sense of civic duty in providing this information accurately and an awareness that accurate information from the ABS requires growers to provide accurate information.

Several growers who reported giving accurate information themselves also reported that they knew of other growers who did not give such accurate information on the surveys. (This result should be considered with caution. It is common in surveys for participants to overestimate their own skill/contribution relative to others. For example, it is common in driving surveys for a very high proportion of respondents to report that they are "above average drivers".) One grower reported that a big reason for this is that the questions on the surveys are not well formulated and growers "can't be bothered" trying to determine the appropriate response (e.g., the ABS ask growers to report their production of vegetables by weight, when records for many types of vegetables are kept by unit rather than by weight). Another grower reported his view that some other growers intentionally suppress or inflate their figures in the survey reports in order to present a particular picture of their business. He expressed the view that the figures would still be accurate because "things would all even out". (Note that there is no reason in statistical theory why this would be the case; if growers intentionally give inaccurate figures then there is no reason why overstated figures would balance out with understated figures.)

3.5. Discussion of results

Discussion of results is based on the data presented above and the follow-up interviews with growers. The discussion is geared primarily to the survey results, since these involved some attempt at objective sampling techniques (though with many shortcomings that are unavoidable in this kind of survey). The follow-up interviews give some much-needed context to the statistical findings from the survey and suggest possible explanations, but it must be noted that this information was based on a very small and possibly unrepresentative sample of growers. Unless otherwise stated, all statistics come from the raw data rather than the rescaled data.

Awareness and use of AUSVEG statistical information: Data on the use of existing AUSVEG statistics showed that there is already a reasonable amount of access of statistical data on the AUSVEG website. Two-thirds of the respondents were aware of the statistics on the website and 88% of these had accessed one or more categories of statistics. Most growers accessing the AUSVEG website accessed between 3-5 categories of information but a small number of larger growers had accessed all available categories of information. Rescaled data gave similar results except that there was a more evident "hump" in access of between 1-5 categories and fewer growers that accessed all available categories of information. Follow-up interviews had similar results, with most growers being aware of the website and reporting having looked at the statistics reported there. Follow-up interviews suggested that larger growers were aware of the information on the AUSVEG site and had browsed all of the relevant information without looking for any particular piece of data. The survey data and follow-up interviews cumulatively suggest that growers tend to go to the website without a specific piece of data in mind, and browse data sources of interest.

The most widely accessed category of information on the AUSVEG Industry Statistics website was data on vegetable production (73%). After this were statistics for specific vegetable types (50%), vegetable use (50%), prices (47%), yields (42%) and vegetable grower statistics (42%). This is consistent with the follow-up interviews insofar as these found that several growers were interested in obtaining production and price data to obtain an understanding of the likely returns on lines of vegetables. (The explanatory power of the follow-up interview is limited here since most of these growers expressed an interest in more timely market-report data rather than the ABS data that is given on the AUSVEG website.) The least commonly accessed items were trade data (35%), financial performance data (30%), farm characteristics (23%) and vegetable growing conditions (20%). The latter consisted mostly of information on whether

vegetables are grown indoors or outdoors at different farms. The rescaled data showed similar results except that there was less access to statistics on vegetable use and trade data. There was even less access in the rescaled results to data on farm characteristics and growing conditions. All of this suggests that growers are less interested in data pertaining to vegetable farms rather than data pertaining to vegetable production and markets. This is evident both among the respondents to the survey and in the rescaled estimates accounting for size of growers.

Usefulness of different kinds of data: Measures of the usefulness of different categories of data were given on an ordinal scale with the most useful outcomes being "very useful" and "useful". Here we report raw data percentages on a cumulative scale in the form (X%/Y%) with X being the percentage of respondents classifying the relevant category of data as very useful and Y being the percentage of respondents classifying the relevant category as either useful or very useful (a cumulative category).[18] (So, for example, a percentage report of (20%/60%) would mean that 60% of the respondents classified the relevant category of data as being either useful or very useful, and 20% of respondents —one–third of the 60%— classified the relevant category as very useful.)

Data on the usefulness of categories of data showed a high level of usefulness for data on prices (42%/74%). Almost three-quarters of all respondents rated this category of data as either important or very important and almost half rated it as very important. After this were high levels of usefulness for data on consumption (34%/70%), market research (33%/74%), climate and weather (31%/70%), vegetable use (30%/69%), vegetable yields (29%/72%) and trade (29%/56%). All of these categories of data had high levels of reported usefulness based on reports in the "very useful" response. For all of these categories except trade, at least one-third of respondents rated them as either useful or very useful. Pricing data was the category that was reported as being the most useful among the growers in the survey in overall terms.[19] The rescaled data showed similar results to the raw data with an overall change showing lower levels of usefulness for most categories of data. The main change due to rescaling was a greater estimated level of usefulness for climate and weather data and lower usefulness for most other categories of data. This change was consistent with the weak to moderate negative correlation in the raw data between EVAO and usefulness of climate and weather data (−0.20)

[18] For present purposes we do not report on the distinction between data that is reported as "not useful" versus data that is "somewhat useful". This data is available in Table A.5 in Appendix A.
[19] This category was ordinally-dominant over all the other categories and was strictly ordinally-dominant over all categories except for market research.

Data on vegetable prices were more useful to smaller growers according to the measured rank-correlation, though this result was only weak (−0.06). This accorded with the information from follow-up interviews, which suggested that larger growers with fixed price contracts were less interested in price data than smaller growers operating on a speculative basis. Rescaling based on EVAO led to a small change in usefulness for vegetable prices but this clearly remained as the top category. Climate and weather data was also found to be more useful to smaller growers and this was the highest level of correlation found, though it was still only weak to moderate (−0.20). It is not clear from the data or follow-up interviews why this is the case, though it may be due to the more precarious nature of a smaller business and the greater proportional effect of loss of any given crop harvest. Most other categories of data were reported as being more useful to larger growers. This was most evident for data on consumption of vegetables and marketing to consumers (+0.13 and +0.10 respectively). Rescaling of the data reduced the usefulness measures of these categories somewhat. This may be evidence of greater focus on marketing by large producers, though the evidence on this item is quite weak.

The categories of data reported as being least useful to growers in the survey were data on farm characteristics (16%/46%), vegetable growers (15%/57%), growing conditions (14%/49%) and data for growers outside Australia (10%/44%). These categories all had low levels of reported usefulness with less than half of growers reporting these categories as either useful or very useful. These categories of data all remained at low levels of usefulness under the rescaled data and even lost some ground. Data on financial performance (24%/58%) was also reported as being less useful than most other categories. Data on vegetable production (22%/67%) was more ambiguous in its ordinal ranking since a sizable proportion of respondents reported this as useful but few reported it as very useful. Under the rescaled data the estimated usefulness of vegetable production data declined to lower levels consistent with other low-end categories.

The results on usefulness of the various data categories accorded reasonably well with the results on access to statistics at the AUSVEG website; with the exception of production data, the categories that were reported as being more useful were generally more heavily accessed and the categories reported as being less useful were less heavily accessed. This was evident in both the raw data and in the rescaled data. The fact that larger growers were found to have accessed more categories of data also accorded with the fact that they reported higher usefulness on most categories of data, particularly those published by AUSVEG. This meant that the rescaled data tended to show lower levels of estimated usefulness than the raw data.

Importance of data characteristics: Data on the importance of various characteristics of data showed a high level of importance for data accuracy (61%/93%). This remained the case once rescaling was applied. The rescaled data again showed that accuracy was the most important characteristic to growers and that the vast majority rated this characteristic as either important or very important.

It is worth noting that this question can essentially be regarded as a calibration question on the importance of data itself, since a report that accuracy of data is not important is tantamount to a report that data itself is not important. (Only one respondent said that accuracy in data was not important.) The vast majority (93%) of survey respondents reported that accuracy was either important or very important to them. Those that reported accuracy as being unimportant or only somewhat important tended to be smaller growers who showed little interest in any of the categories of data in the survey. (As previously noted, only one respondent reported accuracy as unimportant, and this respondent also indicated that no categories of data were useful or very useful. This respondent also indicated that he uses statistical data solely for general interest/education.)

Second to accuracy, the most important characteristic of data reported in the survey was that it be updated regularly and promptly (42%/91%). Again, the vast majority (91%) of survey respondents reported that this characteristic was either important or very important to them. This was also the second highest ranked characteristic in the rescaled data, with a similar proportion of respondents estimated to regard this as either important or very important. This preference for regular and prompt updating of data was also evident in the follow-up interviews where growers expressed the importance of timely statistical information and criticised the ABS data on the basis that it was not sufficiently timely to assist them with their business decisions. Several growers in the follow-up interviews mentioned the usefulness of email alerts and other facilities to allow them to get timely notification of data releases or updates to data.

Regular and prompt reporting of data was reported to be important across the board, both by smaller and larger growers. (There was only a very weak negative correlation with grower size evident in this question.) Both this characteristic and the accuracy characteristic came out as clear favourites in both the raw and rescaled data. The information obtained from the grower survey and follow-up interviews suggests that the primary characteristics of importance to growers in their data needs are accuracy of the data and timeliness of its provision. This is consistent with the fact that growers require timely information for their business decisions.

Recommendation 2: AUSVEG should implement a workplace system to ensure that data on its website is updated promptly once new data becomes available. AUSVEG should also consider implementing a system of email notifications to allow growers to get immediate notification of updates to data sets of interest to them. (Since growers with membership access on the AUSVEG website already enter information on their activities for the purposes of providing suggested reports, it might be possible to build a system of email notifications into this.)

Other characteristics reported as being important were discussion of methodology (31%/65%) and specification of the data source (30%/75%). These characteristics were rated as being important in both the raw data and the rescaled data. Though the survey did not ask for information on the exact level of detail required by growers, follow-up interviews suggested that growers would require sufficient detail to access the original source of the data themselves. (This is also prudent insofar as it allows growers to easily confirm the accuracy of information supplied by AUSVEG and obtain surrounding discussion of methodology.)

Recommendation 3: AUSVEG should update the existing statistical information on its website to give details on the data source and a referral to discussion of the methodology used for data collection. For ABS data this can be done by including specification of the relevant report and page number that the data was taken from (not just the name of the agency) and a reference to the page numbers in the ABS report where the methodology of data collection is discussed. (Usually this is in explanatory notes at the end of the ABS report.) Depending on the formatting and medium of the AUSVEG document, references or hyperlinks to the primary source document at the ABS could also assist growers in this regard.

Less important characteristics among those in the survey were historical comparisons of data measures (21%/81%) and display of data in graphs (11%/42%). Though data on historical comparisons of measures were not important across the board this was more important to larger growers according to the rank-correlation measure (+0.30). This characteristic showed a reasonably high level of importance in the raw data but this declined substantially in the rescaled data due to the reduction in weighting to large growers. This suggests that whether or not this characteristic is of major importance depends on whether one focuses on the kinds of larger data users that proactively responded to the grower survey, or the wider population of growers, with its regular size distribution.

Use of statistical data in business: Responses on the uses of statistical data showed a large number of growers using data for general interest/education (68%). Use of data for general interest/education came across as a common usage in both the raw data and the rescaled data. These respondents also tended to use data for more kinds of other business decisions than those who did not report this general interest/education. This was evident in the examination of individual response items and also evident in the moderate positive correlation (+0.43) between this use of data and the count of other uses of data. This moderate positive correlation shows that this characteristic has reasonably good predictive value in determining the number of types of data use of growers in the business activities listed in the survey.[20] (Correlations between this outcome and other measure of data use were also high relative to most of the correlations evident in the data.)

This result suggests that growers that use statistical data for general interest or educational purposes also have a greater tendency to use data for business decisions. (Note that the survey data does not give any basis for a causal finding here and can only show correlation between these uses. Still, it is plausible that there would be a two-way causal connection between use of statistical data in business decisions and a general interest in statistical data. That is, it is a plausible causal hypothesis that a general interest in data would lead growers to use data in their business decisions and use of data in business decisions would foster a general interest in data. In any case, regardless of the causal relationship, this still serves as a useful predictor for use of statistical data for business decisions.)

> **Recommendation 4:** In targeting statistical information to growers AUSVEG should concentrate on providing information to growers that show evidence of having a general interest in statistical data. This is not only valuable in the obvious sense of targeting to an audience that is interested in the product; it is also useful since this characteristic appears to be a good predictor of use of data in business decisions (i.e., growers with a general interest in statistical data are more likely to use this data in their business decisions).

[20] As a caveat to this result the reader should note that there is some arbitrariness to this correlation measure. This is because the counts in the calculation depend on the chosen categorisation of uses in the question. A finer or courser categorisation including other uses would be expected to lead to different correlation values. It is best to use this correlation measure (and other similar measures) as indicative of some predictive relationship between the reported uses of data, but not as a definitive measure of the relationship.

Reasonable numbers of respondents used statistical data for short-term and long-term business planning decisions. The survey itself did not give the respondent a definition of this distinction between short and long term planning and instead left it to the respondent to interpret this. The relative usage for these types of decisions was somewhat ambiguous and there was a difference between the raw data and the rescaled data. In the raw data, more respondents reported using statistical data for long-term decisions (73%) than short-term decisions (59%). In the rescaled data the proportion of growers using data for long-term business decisions declined to a level where short-term uses were more common.

Usage of statistical data for short-term and long-term decisions were only weakly correlated (+ 0.26) suggesting that though these uses have some weak tendency to go together there was some residual dichotomy in these usages among the respondents. Use of data for long-term decisions had moderate positive correlation with marketing (+ 0.41) and with comparison/ benchmarking to other businesses (+ 0.37). This is to be expected since both of these activities are usually related to long-term business planning. Use of data for long-term planning had moderate positive correlation (+0.51) with the count of other business-related uses of data, suggesting that it is a good predictor of other types of data use.[21]

The higher reported incidence of long-term planning use (compared to short-term planning) in the raw data contrasted with the opposite result in the scaled data. The follow-up interviews were more consistent with the latter. Several growers reported using statistical data from market reports for short-term decisions on growing, harvesting and sales. This tended to be the case more among smaller growers engaged in speculative growing activities.

There was a sizable contingent of respondents who reported using statistical data for marketing (53%) and comparison/benchmarking against other businesses (49%). Only a relatively small number of growers used statistical data to lobby government (17%). As expected these were almost exclusively larger growers, or growers who declined to provide an estimate of their EVAO. (Of those who provided an estimate of their EVAO almost half of the growers using statistical data for lobbying had a reported EVAO over $2 million. There was only a single respondent with a low EVAO who reported using statistical data to lobby government.) This meant that reported usage of data for lobbying government declined even further in the rescaled data as did usage for business comparison.

[21] See caveat in previous footnote. This caveat applies here also.

Table 3.1. Summary of survey findings	
Awareness/use of AUSVEG statistical information by growers	• Two-thirds of growers are aware that AUSVEG provides industry statistics on its website. • Most growers that have accessed AUSVEG statistics have accessed between 1-5 categories of information (out of 10 categories considered). Several larger growers have accessed all available categories of information. • Growers mostly accessed data on vegetable production; also accessed data on vegetable prices, yields, use, and data on vegetable growers. Roughly half of growers accessed information about a specific type of vegetable.
Kinds of data that growers find useful	• Larger growers tend to find most categories of statistical data more useful than smaller growers. • Both large and small growers find data on vegetable prices to be the most useful category of statistical information. • Smaller growers also find data on climate and weather to be highly useful, but this is less useful to large growers. • Other categories of data with high reported rates of usefulness were data on consumption, marketing, vegetable use and vegetable yields.
Data characteristics that are important to growers	• Most important characteristic of data is accuracy. The vast majority of growers reported this to be either important or very important. • The next most important characteristic of data is that it be updated regularly and promptly. The vast majority of large and small growers reported this to be either important or very important. • Also important were specification of the data source and discussion of methodology. Historical comparison was important to larger growers, but less important to smaller growers.
Uses of statistical data by growers	• Around two-thirds of growers use statistical data for general interest/education. This form of usage is also a good predictor of usage for business-related decisions. • More than half of growers use statistical data for short-term business decisions. More than half of growers use statistical data for long-term business decisions. These uses are weakly correlated. • Larger growers are more inclined to use statistical data for long-term business decisions than smaller growers. • Around 40-50% of growers use statistical data for marketing and business comparison/benchmarking. Larger growers are more inclined to the latter than smaller growers. • Very few growers use statistical data to lobby government. This is almost exclusively larger growers.
Methodology and caveats on findings	• These findings were based on an online survey sent to 3175 listed growers on the AUSVEG contact list. There were 120 eligible growers that responded. • The respondents included a preponderance of larger growers. Data was rescaled to account for this and results did not change markedly with this rescaling of results. • Due to time constraints the present survey did not involve a probabilistic analysis of the likely size of sampling errors. However, these errors could be substantial, particularly in the rescaled data.

4. Review of the sampling frame for government census and surveying

In order to conduct surveying work to obtain data on the vegetable industry the surveyor needs a list of vegetable growers operating in that industry. We have already discussed some of the difficulties in obtaining a complete list of growers in previous sections. These problems lead to a situation where it is necessary to restrict the scope of any survey work to an identifiable class of vegetable growers who are known to exist and can be contacted by the surveyor.

Survey work on the vegetable industry is conducted using a **sampling frame** which lists the entities that can be chosen for the survey. This is usually a register of businesses operating in the vegetable industry, with each survey unit in the frame being a business enterprise. In order to be usable for surveying work the sampling frame must have sufficient information on each enterprise to allow the surveyor to contact the businesses in the sampling frame and observe characteristics of interest.[22]

4.1. The Australian Bureau of Statistics Business Register (ABSBR)

Most of the survey work done on the Australian vegetable industry is done using a sampling frame consisting of businesses listed on the Australian Business Register (ABR).[23] Businesses in Australia are able to register an Australian Business Number (ABN) on this register in order to avoid adverse tax-remittance obligations that apply to non-registered businesses. (Though it is legal for a business to trade without an ABN this leads to a legal obligation to withhold taxation from incoming payments at the top marginal income tax rate. This creates an incentive for registration of an ABN for any business that earns income subject to taxation.)[24] Businesses with an ABN are registered on the Australian Business Register (ABR) and this is maintained by the Australian Taxation Office (ATO). This register is regularly updated to add new businesses and remove businesses that cancel their ABN.

Most of the businesses on the ABR have a simple business structure and a focused area of business, which means that they are suitable for the statistical requirements of surveying. In such cases a single registered business constitutes a single survey unit for the purposes of

[22] Further explanation of the sampling frame and its properties a can be found in Särndal, C., Swensson, B. And Wretman, J. (2003) *Model Assisted Survey Sampling*. Springer-Verlag: New York, pp. 9-12.
[23] ATO • *The Australian Business Register* • 19 July 2011 [Accessed on 7 November 2012] http://www.ato.gov.au/taxprofessionals/content.aspx?doc=/content/00286216.htm&mnu=51224&mfp=001/005
[24] ATO • *ABN Registration* • 14 September 2012 [Accessed on 7 November 2012] http://www.ato.gov.au/businesses/content.aspx?doc=/content/57752.htm

surveying. However, some of the businesses on the ABR have more complicated structures involving relationships between multiple business entities. (For example, a large business entity might consist of a parent company and several subsidiaries, or might consist of related companies that work on different parts of the overall business enterprise.) In such cases it is not appropriate to treat each registered business as a single survey unit, since these businesses are all a part of a single overarching business enterprise.

In order to account for the statistical requirements for complicated business structures the ABS maintains a separate register of business entities adapted from the ABR, which they call the **Australian Bureau of Statistics Business Register (ABSBR)**.[25] This latter register includes one category for businesses from the ABR with simple business structures and another category for businesses from the ABR with complex business structures which require the identification of a complex business unit. In the former case the information is maintained on the ABR by the ATO and the ABS draw their information directly from this. In the latter case the ABS maintains its own list of business units in a way that is suitable for its statistical requirements. This is done using a "unit model" developed by the ABS. This unit model is based on direct contact with the businesses to establish their business structure and relationships with other businesses.

The ABSBR allows the ABS and other surveying organisations to identify a single business entity that undertakes a particular type of activity using multiple ABNs so that the surveyor can create appropriate survey units for surveying work. To do this the ABS uses a three part classification of survey units by looking at single enterprises, enterprise groups, and the types of activity conducted by an enterprise or group. The exact structural details of this "unit model" are quite complicated, but the general idea is to identify business enterprises that can be treated as a single statistical unit for surveying work, even if the overall enterprise is composed of several business entities with different ABNs or when the enterprise operates across several industries. The unit model used involves the determination of a "type-of-activity unit" which is a part of a business enterprise operating in a particular field of activity. For complex business entities each of these units counts as a single survey unit.

The basic idea of this register for business enterprises composed of more than one entity with an ABN is illustrated below in Figure 4.1. This gives the basic idea of the model for a business enterprise with a single field of activity, but does not illustrate complications from businesses that operate over different areas of activity.

[25] ABS • *Australian Bureau of Statistics Business Register* • 25 Sept 2007 [Accessed on 7 November 2012] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DOSSbytitle/AC79D33ED6045E88CA25706E0074E77A?OpenDocument

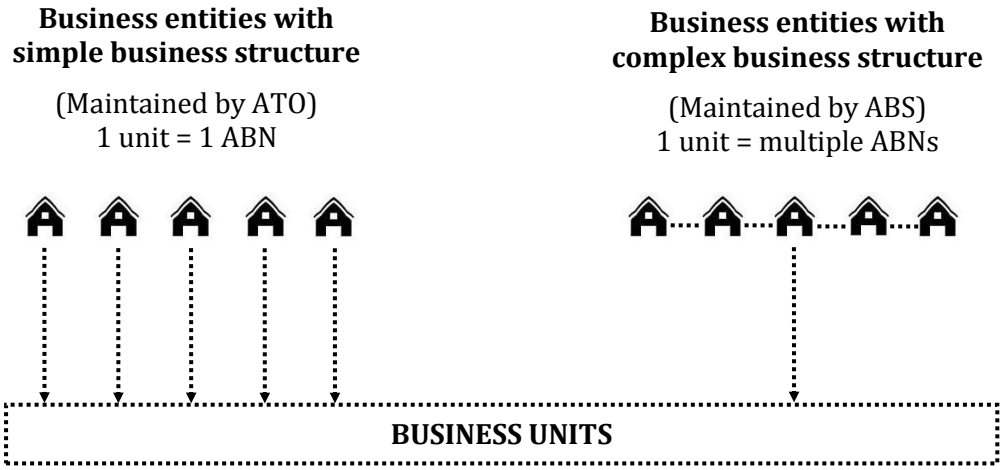

Figure 4.1: Illustration of business units from the ABSBR

The ABSBR is used by the ABS for surveys of businesses and statistics published from these surveys. The "units model" for the ABSBR was redeveloped in September 2002 and has been used for surveys since that time.[26] The main purpose of the ABSBR is to produce an adequate sampling frame for surveys conducted by the ABS and other agencies. It is also a direct source of information for counts of businesses in industries identified in the register. The register is updated using monthly data from the ABR and information from direct contact with businesses, including census and survey information. The ABS take a quarterly "snapshot" of the register and use this as the sampling frame for all surveying work in the following quarter. This allows the ABS and other surveyors to have recent information on business entities and their activities for use in surveying work.

Since the ABSBR draws its information from records of ABNs, it does not identify all vegetable growing businesses operating in Australia. The reason for this is that commercial businesses are not required to register an ABN; some choose to register one but some do not. The fact that registration is only required for tax purposes means that the register is likely to exclude some low-income businesses or businesses that are non-compliant with tax laws. In the context of the vegetable industry these growers would be expected to make a relatively small contribution to the total economic output of the industry. Though there is no way to determine their number or characteristics from available data (since this data comes through the ABSBR itself), discussion with AUSVEG staff and other stakeholders suggests that there are at least some growers in this category, but their output is small relative to the total size of the industry.

[26] Ibid, ABS • *Australian Bureau of Statistics Business Register*.

The scope of the ABSBR is illustrated in the flow chart in Figure 4.2. This process begins with all economically active entities in Australia and filters them by ABN status, GST status and ANZSIC classification to obtain eligible businesses which are then analysed under the ABS unit model.

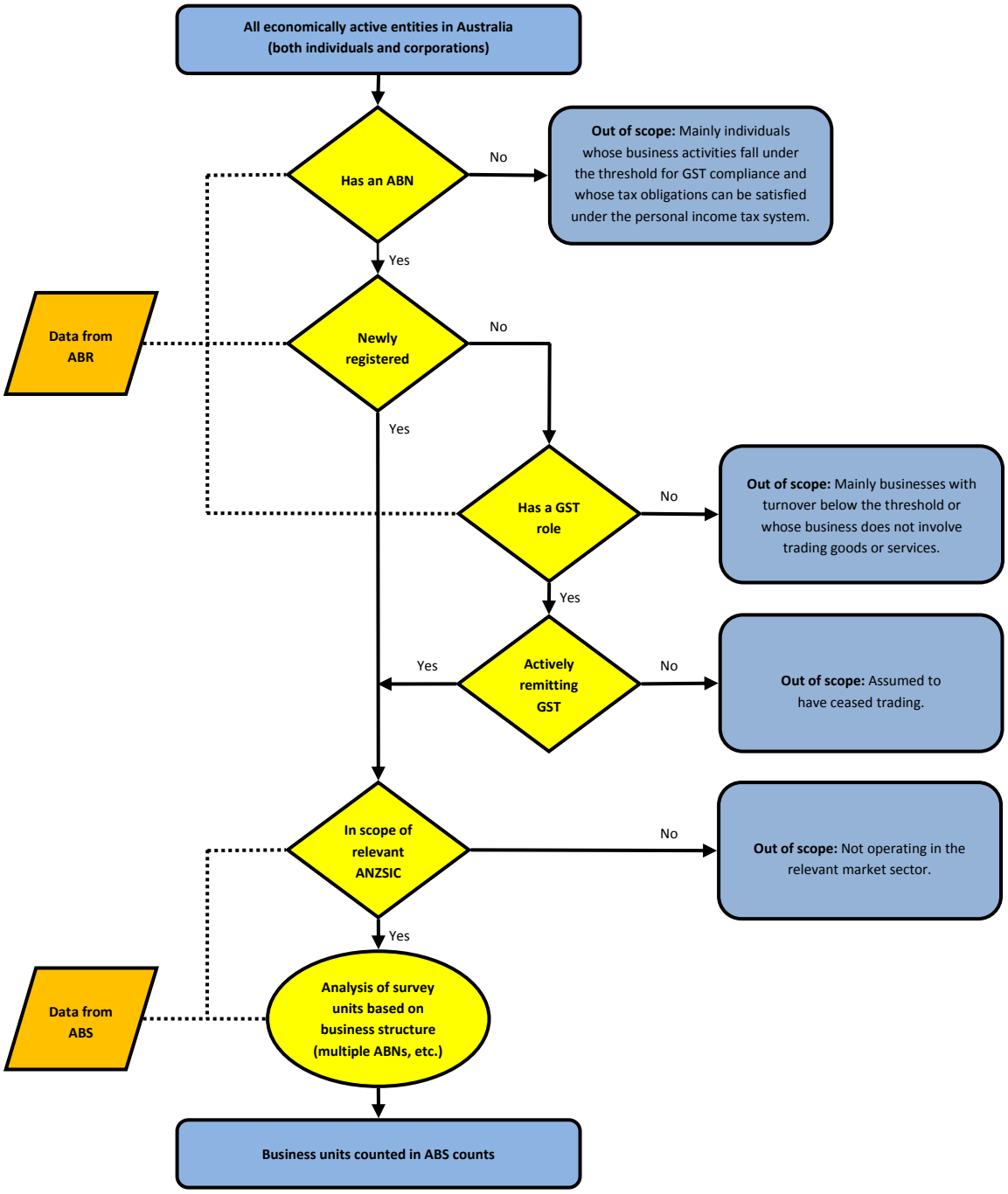

Figure 4.2: Flow diagram for ABSBR sampling frame[27]

[27] This flow chart is adapted from ABS • *Counts of Australian Businesses, including Entries and Exits* • 8165.0 • 2005-06, p. 4 (Diagram 1).

4.2. Counts for vegetable growing businesses in the ABSBR (by primary activity)

The ABSBR includes a range of information on the businesses in the register. This information is taken from business reports to the ATO as well as supplementary information obtained by ABS during its surveying and business contact activities. Businesses are classified into different industries by the Australian and New Zealand Standard Industry Classification (ANZSIC).[28] There is also information broken down by specific types of vegetables, but this information is limited and most of the reported results from the register use broad categories from the ANZSIC classification. This creates a difficulty for AUSVEG and vegetable growers, since the categories in the ANZSIC classification cover a wide range of vegetables, not all of which are of interest in any particular analysis. The information reported from the register gives a broad overview of producers in the vegetable industry as a whole, but there is limited information published about specific types of vegetables.

Within the ANZSIC classification framework there are three categories of vegetable growers:[29]

- **Mushroom Growing (A0121):** This class consists of business entities mainly engaged in growing cultivated mushrooms in climate-controlled environments. The primary activities in this class include cultivated mushroom growing and mushroom spawn growing. Does not include growing truffles or gathering forest mushrooms.
- **Vegetable Growing (Under Cover) (A0122):** This class consists of business entities mainly engaged in growing vegetable crops under cover. This includes greenhouses, cold frames, cloth houses, lath houses and hydroponic systems. Does not include processing frozen vegetables, including freezing, dehydrating or canning.
- **Vegetable Growing (Outdoors) (A0123):** This class consists of business entities mainly engaged in growing vegetable crops outdoors in open fields. Does not include growing dry field peas, beans or soybeans.

In addition to these main categories, there is also a category that contains a minor amount of vegetable growing activities for animal fodder, but not for human consumption or seed:

- **Other Crop Growing (A0159):** This class consists of business entities mainly engaged in growing horticultural crops and plants not elsewhere classified. This includes many activities that do not relate to vegetable growing, but also includes vegetable growing for animal fodder.

[28] ABS • *Australian and New Zealand Standard Industrial Classification* • 1292.0 • 2006.
See also ABS • *Australian and New Zealand Standard Industrial Classification (Revision 1.0)* • 1292.0 • 2006.
[29] Ibid, ABS • *Australian and New Zealand Standard Industrial Classification*.

Vegetable growth for human consumption and seed cover the first three ANZSIC categories listed above (A0121-A0123). This includes all vegetable categories, including many vegetable categories that may not be of interest in some AUSVEG work. The ABSBR classifies business units in the register according to this classification framework.

Count data for agricultural industry classifications is contained in the agricultural commodity data published by the ABS.[30] Published count data for the vegetable industry is inconsistent and haphazard. Different metrics are reported in different years in the agricultural commodity results and these do not allow for consistent comparison even over a short number of years. In some data sets the results are split between the present ANZSIC categories and in other data sets these are aggregated into wider categories. Count data in different parts of the reports are based on different activity requirements: some counts are done only by primary activity and others are done by including all activities. In the latter case there is a further breakdown of vegetable production into production for human consumption and production for seeds, but the reported data do not allow the reader to aggregate these categories to get counts for the industry overall. Published reports on each of these categories present different categories from year-to-year and this prevents reliable comparison even over a short number of years.

There are different ways that business units performing a particular industry activity can be counted in the ABSBR. In breakdowns of business counts by state and EVAO the counts are done only for businesses that undertake vegetable growing as their *primary activity*. These are estimated according to information that prevails in the register at the end of each financial year. (The reason that estimation is required is that the information is taken from ABS censuses and surveys where the response rate is less than the full population; this information is different to the information reported to the ATO.) Reported data on these business counts generally follows the ANZSIC classification but in some years the relevant categories are aggregated.[31] This means that it is possible to obtain values for the aggregated categories from year-to-year but it is not possible to obtain a more detailed breakdown. Unless the specific breakdown of the three ANZSIC categories is of use to AUSVEG this is not likely to be a problem — the aggregated values give counts for all business units with vegetable growing as their primary activity.

[30] ABS • *Agricultural Commodities* • 7121.0 • 1997-2011 (14 reports).
[31] The undercover and outdoor categories (A0122-3) were aggregated in the 2007-08 outputs and the 2009-10 outputs, but were presented separately in each other report in the past six years.

The count values undertaken by this method are shown in Figure 4.3 below. These give counts for business units in the ABSBR based on the ANZSIC classification reported as their primary activity in the business unit. This shows the number of businesses reaching an initial peak in 1999-2000 and then declining. The reported count of vegetable growing businesses in 2005-06 corresponds with a change in categorisation due to a change in the ANZSIC classification in 2006.[32] Hence the change is most likely to be due to the change in category definitions rather than a major substantive change in the industry. The ABS note that "[t]he key implication of the move to the new register is that the 2005-06 Agricultural Census data will not be directly comparable with the historical time series of agriculture data."[33] After this jump the count values decline again until their most recently reported value in 2010-11.

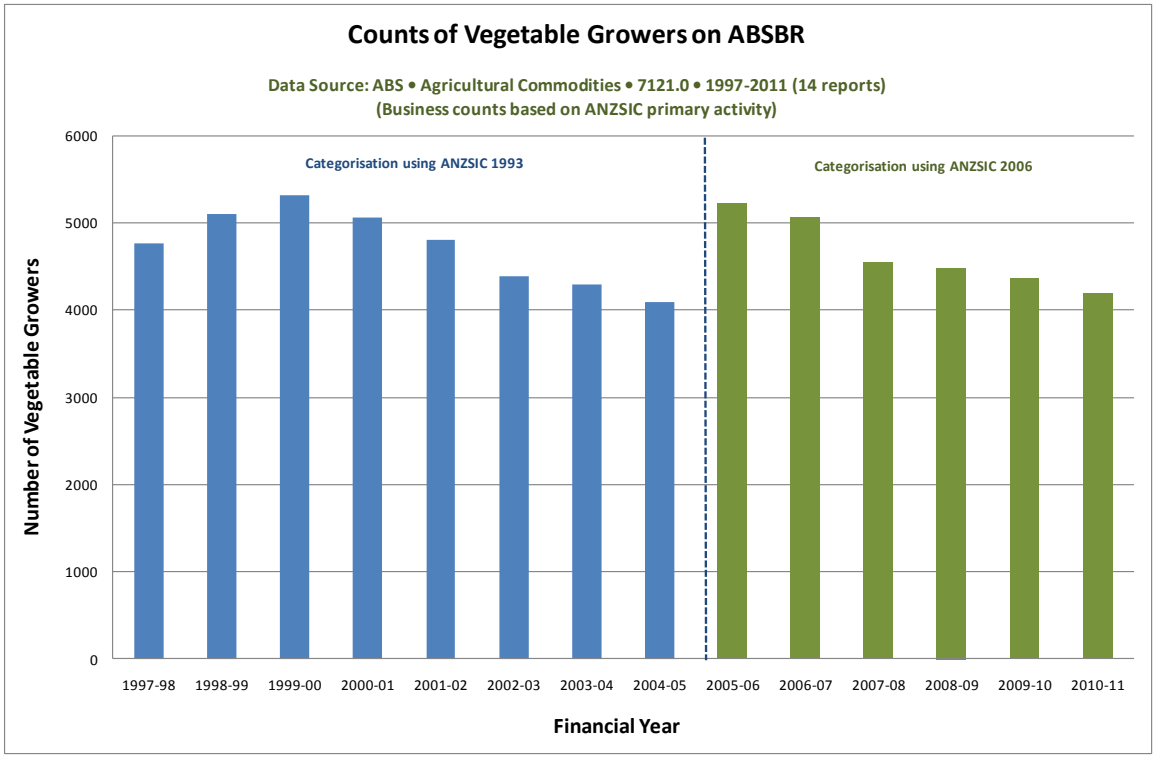

Figure 4.3: Counts of vegetable growers on ABSBR

(Data for this chart is shown in Table B.1 in Appendix B. The count values aggregate vegetable growers and mushroom growers. It is possible to remove mushroom growers from the counts after the 2005-06 ANZSIC classification. For the purposes of the present counts the mushroom growers have been left in even though they may not be relevant to the operations of AUSVEG.)

[32] ABS • *Agricultural Commodities* • 7121.0 • 2005-06, p. 33 (Notes 11-12).
[33] Ibid, ABS • *Agricultural Commodities*, p. 36 (Note 5).

The count values for growers taken from this data source are limited to certain types of growers by the underlying sampling frame. The count values are only for business units identified by the ABS through one or more registered ABNs. They are also limited to business units that report vegetable growing to be their primary activity. This count value would therefore exclude some small businesses and individual growers that do not have an ABN, and some large growers who also operate other business activities that are more fundamental to their business.

Published ABS reports break aggregate count data down to give estimated business unit counts in each State and Territory. This gives count data for business units whose primary activity is vegetable growing. The most recently reported count values are shown below in Figure 4.4.

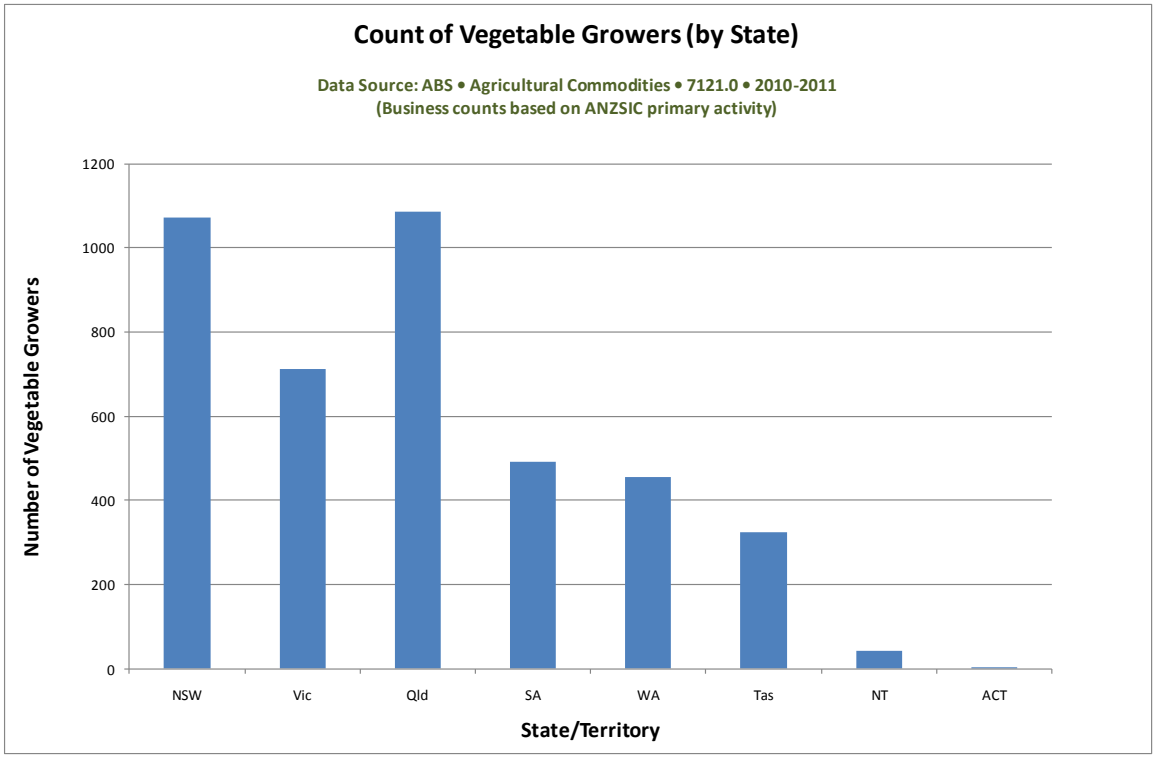

Figure 4.4: Number of vegetable growers by State

This chart shows estimated counts for each State and Territory which can be used to get an impression of the number of growers in each location (subject to the previous caveats we have mentioned). These values are not useful for direct comparison between different States/ Territories since these have different populations of residents and businesses. In order to get a better sense of where numbers of vegetable growing businesses are concentrated it is better to compare the business counts for vegetable growers with the total counts of business units in each location, or alternatively, the resident population of each location. These comparisons are

shown below in Figure 4.5. This makes it clear that there is a relatively large number of grower businesses in Tasmania compared to other States and Territories. (Both graphs are similar in shape since the number of business units per resident does not vary much between states.)

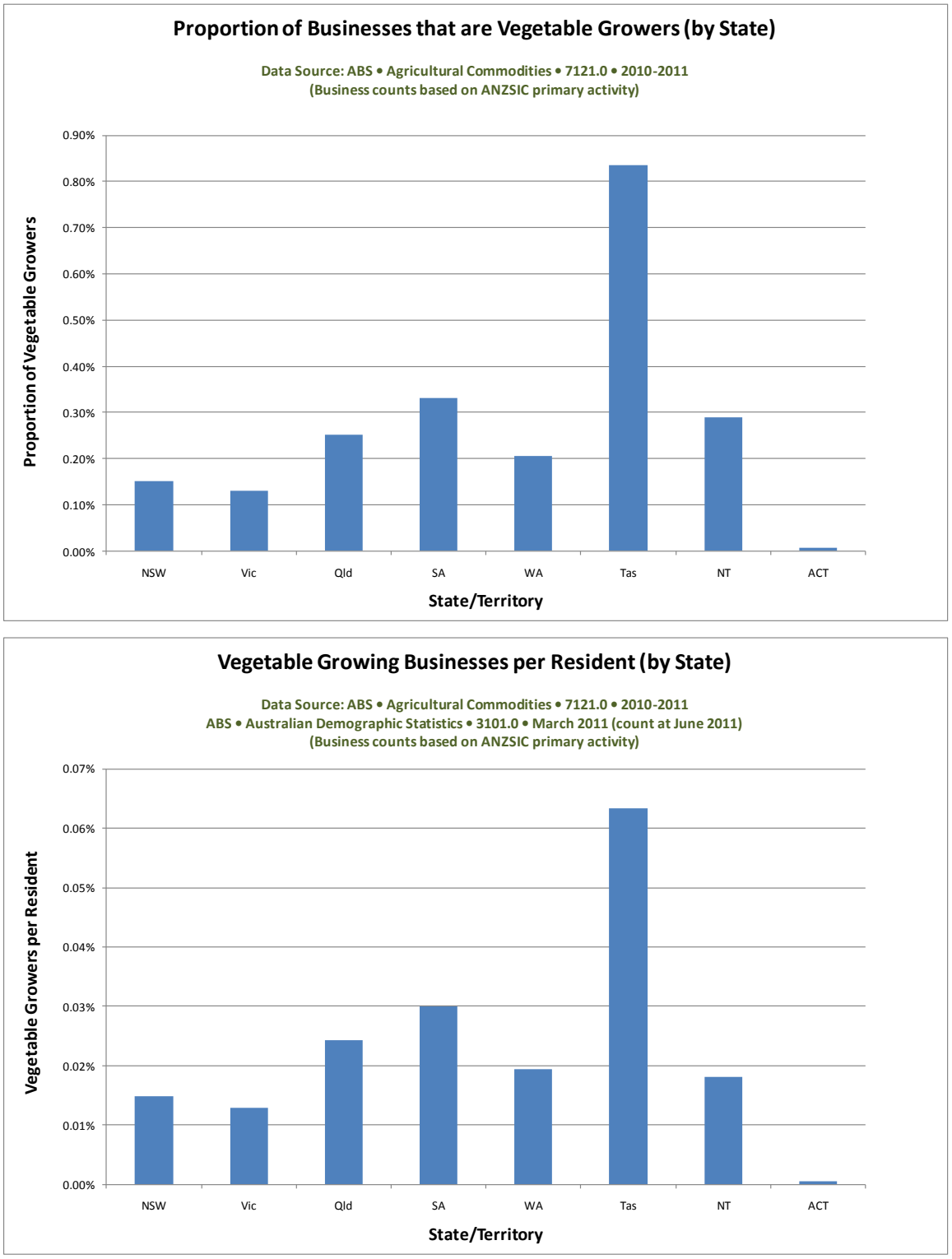

Figure 4.5: Proportion of vegetable growers by State (a) per business (b) per resident

(Data for the charts in Figures 4.4-4.5 are shown in Table B.2 in Appendix B. The count values for growers aggregate indoor and outdoor vegetable growers and mushroom growers.)

These outcomes give a sense of the number of vegetable growers operating in different States and Territories in Australia, in absolute terms, and relative to counts for businesses and residents. This shows relatively large numbers of vegetable growing businesses in Tasmania, relative to business and resident populations in that State. These findings are indicative only, in that the counts are restricted to business units with one or more ABNs. It is also worth noting that the above information does not include any information about the size of businesses in financial terms; business units are counted rather than valued.

Published ABS data also break the aggregate count data down to give estimated business unit counts by categories of Estimated Value of Agricultural Output (EVAO). This gives us some understanding of the distribution of growers by size, with size measured by output value. This again gives count data for business units whose primary activity is vegetable growing. The most recently reported count values are shown below in Figures 4.6 and 4.7. Figure 4.6 gives the counts in the EVAO intervals used in the data and Figure 4.7 converts this information to a histogram of EVAO values by showing the scaled densities and interval length properly.

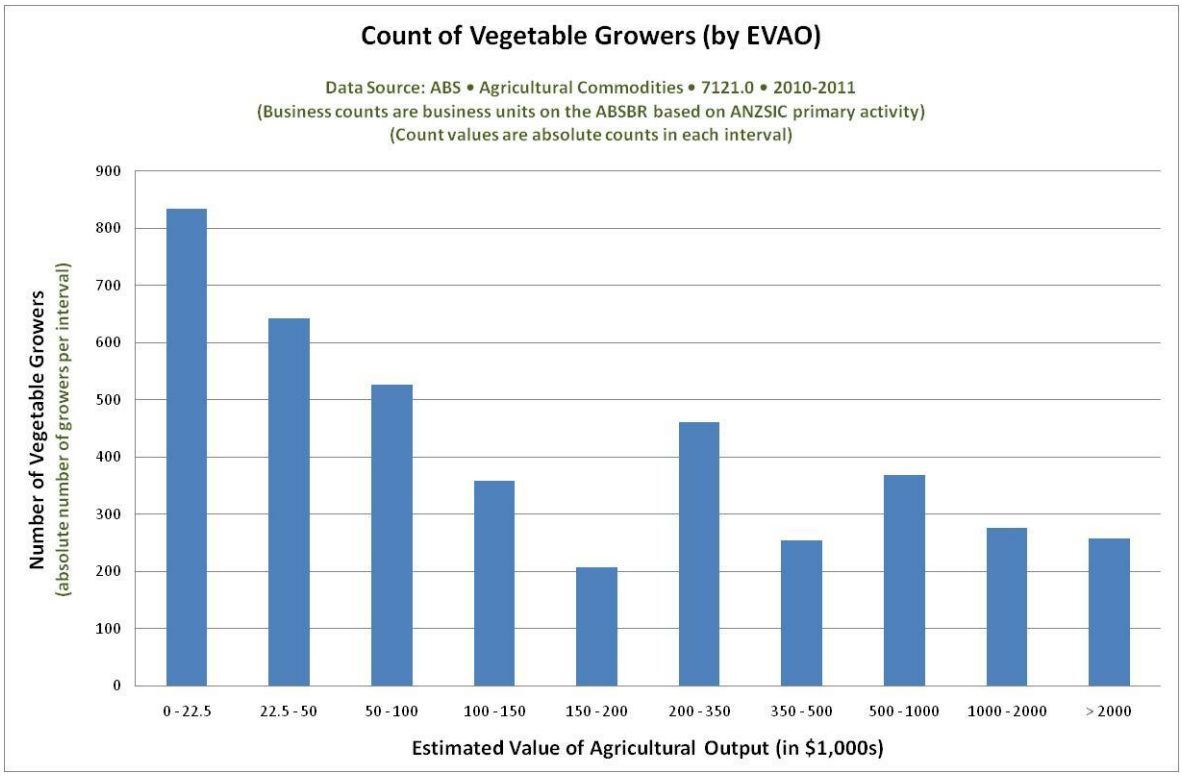

Figure 4.6: Number of vegetable growers by EVAO

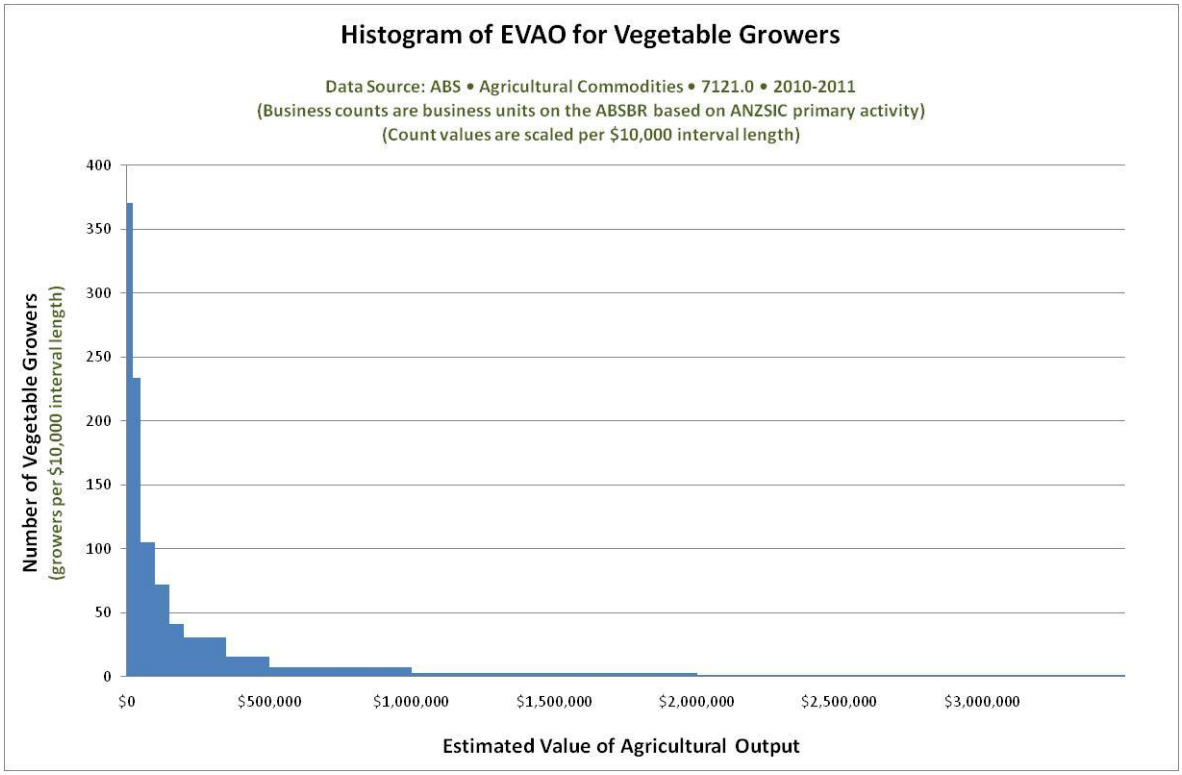

Figure 4.7: Histogram of EVAO for vegetable growers

(Data for Figure 4.7 is shown in Table B.3 in Appendix B. Due to unequal interval lengths in the data this histogram is constructed using the frequency density with values scaled to show the number of growers per $10,000 interval length. The last interval had unspecified length in the reported data; we have taken it to have a length of $1.5M for graphical purposes. The reader should note that this length choice is arbitrary and a change would affect the height of the last interval appearing in the graph, though it would remain low.)

The breakdown of business counts by EVAO shows strong positive skew, with large numbers of smaller businesses evident when scaled to EVAO intervals of a fixed length. This is a common pattern in counts of businesses by output but it is highly pronounced here. It occurs because larger businesses have wider spread of values in output.

In order to gain a greater understanding of the representation in the survey of growers that we have previously analysed it is worth contrasting the distribution of growers in the ABSBR frame with the respondent growers in the survey. Comparison of these two groups shows that the respondents to the survey overrepresented large growers to a substantial extent. This disparity is evident in the contrast between Figure 3.6 and Figure 4.6.

4.3. Counts for vegetable growing businesses in the ABSBR (all activity)

The above data is for counts of business units based on the *primary activity* of each business in the ABSBR. However, in breakdowns of vegetable production for human consumption and seed by specific types of vegetables the business counts are done by looking at all businesses that undertake vegetable growing activity, even if this is *not their primary activity*. This would include businesses whose primary activity is some other agricultural area (e.g., raising cattle) but which grow vegetables as a secondary part of their business. It is worth noting that the vegetable growing activities of such businesses may still be substantial, especially if the overall business is large. These are estimated according to information that comes into the register during each financial year. (Again, the reason that estimation is required is that the information is taken from ABS censuses and surveys where the response rate is less than the full population.)

Reported data on these business counts do not follow the ANZSIC classification and are instead broken down by production for human consumption and production for seeding. The reporting on these categories is inconsistent; in some years only one category is reported and in some years neither category is reported.[34] A further complication in looking at this data is that the counts for vegetable production for human consumption and seeding are treated and counted separately even though they may overlap. Count values are reported for businesses that grow vegetables for human consumption and separate count values are reported for businesses that grow vegetables for seeding, but no count values are reported for the conjunction of these two categories —i.e., for businesses that grow vegetables for consumption or seeds or both. (It would not be legitimate to add the counts together to obtain the aggregated category since there may be businesses that perform both activities, such that they are included in both count values. This means that it is not possible to obtain the aggregate counts from the separate counts.)

These various complications and various different categorical measurements in the ABS data create difficulties in counting the number of vegetable growers in Australia, including growing which is not a primary activity. Because there is no published data on counts for vegetable growing *overall* (the conjunction of growing for human consumption and growing for seeding) this means that it is actually not possible to determine the number of registered growers from the published ABS data once growing as a non-primary activity is included.

[34] For example, in the 2009-10 report only the count values for businesses growing vegetables for human consumption are reported; production for seed is not reported.

The raw data held by the ABS should be able to resolve these complications quite easily, since this would include information on primary activities and other activities for each business unit. It would be a simple matter for the ABS to calculate the overall count values that would come from conjoining these two reported categories. In order to provide useful count data over time it would be good to obtain consistently categorised and reported count data for businesses whose primary activity is vegetable growing and also for businesses who grow some vegetables, even though this is not their primary activity.

Though aggregated information from the ABSBR is published in various ABS reports, unit data from the ABSBR is not available to the public or agencies outside of government. This is because the register includes financial and contact information on each registered business in the register. Enquiries were made with the ABS as to whether it is possible to obtain a reduced version of this data set which removes sensitive identifying information for the businesses on the register but maintains residual information on each unit on the register. They have advised that they cannot make this available to outside agencies.[35] This means that if the count data were of interest it would be necessary to pay the ABS to do these calculations. Depending on whether this is useful for AUSVEG it may be worth considering doing this.

Though mass ABN information is not available from the ABS it is possible to conduct searches on ABNs on a case-by-case basis for known contacts.[36] This information could be used to try to improve the quality of the present AUSVEG contact list, to bring it closer into line with the data in the ABSBR. (This would be a long and cumbersome process and would still only give quite basic information. AUSVEG would need to consider whether there is any value in this additional information.)

> **Recommendation 5:** AUSVEG should consider taking action to obtain improved business count data from the ABS. This should include breakdowns of business counts for categories of interest to AUSVEG and growers, as well as conjunctions of the various categories in cases where these counts include secondary activities by businesses. (Note: Some data of this kind is reported in some years so it may fall within the core business of the ABS. Unfortunately the data that is presently reported is not sufficiently consistent in its form to permit useful results.)

[35] Email correspondence with ABS (Ms Rattana Warren, Agricultural Statistics Branch), 7 November 2012.
[36] This can be done on the ABN Lookup facility at http://abr.business.gov.au/

4.4. Stratification of the ABSBR for sampling

In addition to classifying each business according to its main activities to allow for some count data the ABSBR also includes data on other characteristics of the business. This includes the type of legal organisation, the type of business entity, the States/Territories of operation, the EVAO of the business and classification on the basis of employment size (classified by various ranges).[37] The ABSBR is also linked to other data collected by the ABS under its census and survey activities. (This will be covered in the next chapter.)

The ABSBR allows the ABS and other surveyors to conduct surveys of businesses in a particular industry as determined by the classification in the ANZSIC. Since there is also other information present in the register it also allows the surveyor to undertake **stratified sampling**, where units are surveyed from a range of different categories of business (called "strata"). This allows the surveyor to get a good representation of businesses in each category in the sample. The results from each category can then be weighted according to their proportion in the sampling frame and this allows the surveyor to make useful inferences about the overall frame.

Illustration of the selection of units from the sampling frame according to this process is shown below in Figure 4.8. The stratification must partition the units in the sampling frame into disjoint groups which exhaust all the units in the sampling frame. This is done by separation into mutually exclusive categories.

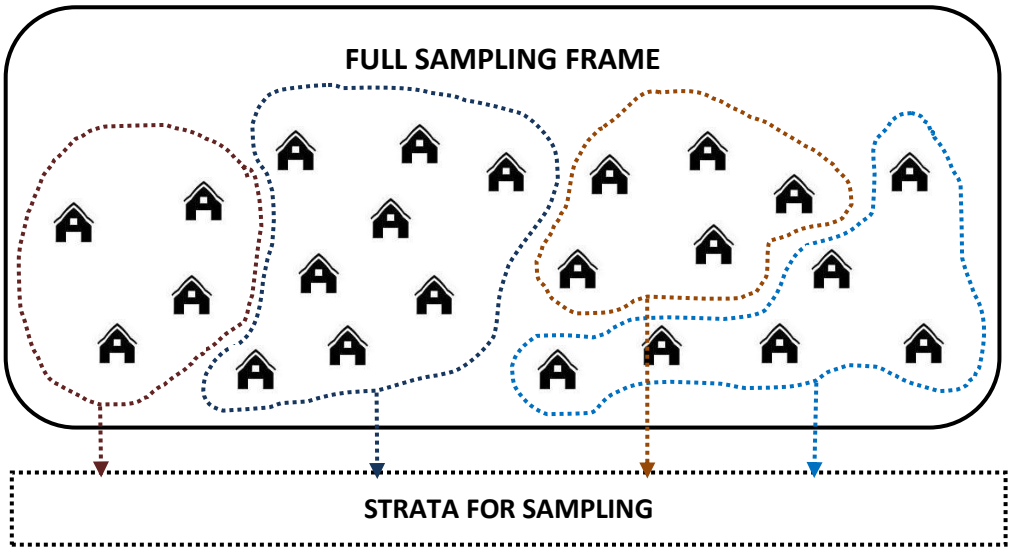

Figure 4.8: Illustration of stratified sampling procedure

[37] Ibid, ABS • *Australian Bureau of Statistics Business Register*.

The agricultural censuses and surveys conducted by the ABS and ABARES use the stratified sampling method based on breakdowns of businesses by State/Territory and EVAO. Businesses are grouped into strata according to these classifications and sampling is undertaken from each of these groups, with a view to obtaining representation of each group. Overall inferences are then conducted by weighting the responses from this sampling process according to the known proportions of each stratum within the overall sampling frame or according to a more complex imputation method. (Further details on this process are set out in the next chapter where we discuss the available data sources.)

(As has already been stated, we have applied a similar reweighting technique to the data from the survey of growers. This was a full survey of all growers on the list and so it did not involve any stratification in the sampling itself. However the responses to the survey were reweighted according to the EVAO categories. This reweighting procedure used the ABSBR count data that we have been discussing in the present chapter.)

5. Review of available data sources

Having established some information about the underlying sampling frame for data collection we now turn our attention to a review of available data on the vegetable industry. This data comes from a number of government and private agencies. The present information has been compiled through examination of data and reporting sources from the following agencies:

- Australian Bureau of Statistic (ABS);
- Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES);
- Australian Productivity Commission (APC);
- United Nations Food and Agriculture Organization (FAO);
- Commonwealth Scientific and Industrial Research Organisation (CSIRO);
- Australian Taxation Office (ATO);
- Global Trade Information Services Inc (GTIS);
- Nielsen, Freshlogic, IBISWorld and other agencies.

In this chapter of the report we set out the details of publicly available data on the vegetable industry from these data sources. We also refer to some data that would be held by these agencies and which might be available subject to negotiations and costs. The agencies contacted were unable to give definite costs for data and surveying work since these are considered on a case-by-case basis. Cost information from inside the vegetable industry (e.g., from HAL) was quite sparse, so the estimation of data costs is limited to a small number of cases.

A note on methodology is in order before proceeding. Consideration of available sources of statistical data necessarily involves some judgment as to where to draw the line regarding relevance and quantification. Strictly speaking, there is no such thing as "statistical data" as distinct from information in general — any piece of information that is amenable to some kind of quantification (even on a categorical or ordinal scale) has the potential to act as statistical data. In assembling the present exposition of available data we have tried to be sufficiently inclusive to give a wide list of data sources while eschewing potential sources of data that either repeat existing data sources in a less useful form or have only a tenuous link to the vegetable industry. Generally speaking, we have included a source of data if it is an original source, if it pulls together information from several sources in a useful way, or if it repeats an existing source in a format that is more useful than the original. We have tried to include a sufficient amount of data sources to give an ample pool of material.

The collection and analysis role of the agencies under consideration differ markedly. The ABS and ABARES collect data pertaining to the industry through direct surveys of growers. Other agencies such as the APC and FAO do not collect their own data, but make use of data from other agencies to produce additional research and reporting, including some quantitative measures of industry performance that are not available from other agencies. Agencies such as the GTIS collect trade data at a broad industry level. Agencies such as Nielsen, Freshlogic and IBISWorld conduct their own analysis based on survey information and other sources of data.

The goal of the present report is not to summarise the *content* of the data available at these agencies, since our concern is only with *availability*. This means that we will have occasion to summarise the kind of data contained in data sets and publications, but we will not perform any analysis of this data or give any explanation as to what it shows. Though we have looked at some of the content of the ABSBR in detail, this was done in order to establish an understanding of the sampling frame for data collection by government agencies. It is not necessary to do this more broadly, and indeed, any attempt to do this for the wide variety of sources considered here would be prohibitive. For the available data presented in this chapter we summarise only the kind of data that is available and the source of this data; we present content only to the extent that it elucidates the categories of data that are available or the method of data collection and the reliability (or otherwise) of the data source. An overall list of data sets and documents considered relevant in this inquiry is contained in Tables D.1 and D.2 in Appendix D. These tables set out a number of documents from various agencies containing statistical data or other information which may be amenable to quantification into useable statistical data.

Though there are a number of nuances in the collection of vegetable data, data on the industry can be broadly construed as coming from one of two directions, either looking at the supply or demand-side of the market. Data collected by agencies such as the ABS and ABARES focuses mostly on vegetables production by obtaining information directly from growers; this looks at the supply-side of the market. Data collected by agencies such as Nielsen and Freshlogic focuses on the purchase and consumption of vegetables by consumers; this looks at the demand-side of the market. These are obviously related, insofar as a sizable proportion of vegetables produced would be expected to show up in final consumption at some point. Nevertheless, there is likely to be some discrepancy between this data due to a number of factors.[38]

[38] Examples of such factors would include unsold vegetables which are produced but not consumed (this would include spoilage of vegetables and other unsold produce), disparities in reporting standard for quantifying vegetables produced for human consumption, and the effects of net foreign trade (though this may be present in a given data source, allowing it to be taken into account).

5.1. Data available from ABS

Most data on vegetable related activities in Australia is obtained and compiled by the Australian Bureau of Statistics (ABS). The ABS provides a Basic Information Set which consists of reports setting out data from the censuses and surveys run by the ABS. These reports are available on the ABS website. As part of its core responsibilities the ABS also provide a National Information Referral Service to advise users on whether or not the ABS collects data on a particular subject of interest. The ABS provides an email subscription service for individuals and agencies that wish to have immediate access and notification of new data sets that have become available.

As part of its surveying practices to obtain data for the Basic Information Set, the ABS conduct a consultation process with major data users relevant to each collection of data. This allows data users to suggest requirements for the surveys.[39] According to ABS information for survey participants, "[w]hen determining what questions to include in a survey, the ABS considers a range of factors, including: whether information can be obtained from other sources; why the data is needed; how the information will be obtained; ability of businesses to provide the information; and costs."[40] This includes consideration of what information should be "essential" (funded by ABS) and what information should be "possible" (funded by outside agencies).[41] The advantage of this process is that it forms part of the Basic Information Set and so it allows users to suggest data that should be provided without cost, as part of the core service of the ABS.

> **Recommendation 6:** AUSVEG should consider participating in the consultation process for the ABS agricultural surveys (including the agricultural census). In particular, AUSVEG should consider making a submission to the ABS on desirable information to include in the Basic Information Set as "essential information" obtained from the surveys. AUSVEG should also alert vegetable growers to this process and encourage them to participate where desirable. AUSVEG should approach this activity with a view to improving the next ABS Agricultural Census which is due to be conducted in 2015-16.

[39] ABS • *Survey Participant Information* • 9 August 2012, Q9. [Last accessed on 7 November 2012] http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Survey+Participant+Information+-+Agricultural+Surveys
[40] Ibid, ABS • *Survey Participant Information* • Q9
[41] On this categorisation, see ABS • *Census Procedures and Output*. [Last access on 20 November 2012] http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/7103.0.80.002Main%20Features32010-11?opendocument&tabname=Summary&prodno=7103.0.80.002&issue=2010-11&num=&view=

In addition to its Basic Information Set, the ABS also have an Information Consultancy Service (ICS) that provide obligation free quotes for additional data. This could be used by AUSVEG or growers to obtain quotations for the costs of specific types of data or additional surveying. The costs for data are determined on a case-by-case basis according to principles of "cost recovery" adopted by the Australian Government.[42] According to ABS cost recovery principles, "[i]n all cases where costs are recovered, the ABS will charge "efficient costs" i.e. the minimum costs necessary to deliver products and services that are fit for purpose."[43] In addition to offering the production of statistics from existing data sets the ABS also allows user-funded questions to be added to censuses or surveys.

> **Recommendation 7:** Data going beyond the published ABS reports is available on a "cost recovery" basis through the Information Consultancy Service at the ABS. Notwithstanding this fact, AUSVEG should exhaust all legitimate avenues of influence over the Basic Information Set before making any large commitments to pay for additional data.

Vegetable data included in the Basic Information Set from the ABS comes from several surveys. Once every five years the ABS conducts an Agricultural Census for comprehensive information from agricultural producers. In the intervening years the ABS conduct an annual Agricultural Survey and Agricultural Resource Management Survey, both using a smaller sample to provide supplementary data. Every two years the ABS conducts a Land Management Practices Survey which also uses a sample of agricultural producers. Each of these studies covers the agricultural industry as a whole, so only part is focused on vegetable growers. These surveys are conducted using the ABSBR as the sampling frame, subject to the imposition of a threshold level of $5,000 for the EVAO. This gives a picture of all business units in the industry with one or more ABNs and GST remittance, over the EVAO threshold. Many of the tables of data from these surveys categorise businesses with agricultural activity into the industry that represents the main activity of the business. This uses the Australian and New Zealand Standard Industrial Classification (ANZSIC). Data available under this classification system includes data on mushroom growers, vegetable growers (indoors) and vegetables growers (outdoors).

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[42] See Department of Finance and Administration (2005) *Cost Recovery Guidelines* (Financial Management Guidance No. 4). July 2005.
[43] ABS • *ABS Pricing Policy* • 31 August 2011 [Accessed on 7 November 2012] http://www.abs.gov.au/websitedbs/D3310114.nsf/4a256353001af3ed4b2562bb00121564/12bb13b927110e44ca2569a80013bec1!OpenDocument#BIS

The Agricultural Census is conducted every five years; the most recent census was conducted in 2011. This is a full census of all growers in the sampling frame, though the survey is still subject to some non-response, and hence, the total number of respondents is less than the number in the sampling frame. The 2010-11 census was administered to all business units with an EVAO above $5,000. The census had a response rate of 88% of businesses overall; the response rate from vegetable growers was not available in the published reports.[44]

The main data collected in the survey were area and production information. These are given in aggregate and also for the varieties of specific vegetables shown previously in Figure 2.2. This included specific data on the following vegetables: asparagus, French beans and runner beans, broccoli, capsicums, carrots, cauliflowers, herbs, lettuce, melons, mushrooms, onions, green peas, potatoes, pumpkins, sweet corn, and tomatoes. Some of these vegetables are broken down into categories for processed vegetables and fresh produce. For each of these vegetables the census collects information on the area of land allocated to the vegetable and the volume of production. This also allows for the calculation of the yield, measured in volume per hectare. Information collected in the survey includes the area of land holdings, area of pastures, area sown, area used for seed, and production of vegetables for consumption and for seeds. The surveys also include information on financial aspects of vegetable production including the value of commodities produced.[45] This information is taken from surveys asking growers to report their production figures for various lines of vegetables. In the 2000-01 census the ABS also included user-funded questions on various land management issues.

Data from the surveys is broken down based on various classes including geographical location, ANZSIC industry classification, area of holding, EVAO and commodity classes. The location information includes classification by the Australian Statistical Geography Standard (ASGS).[46] This divides the total area of Australia into State/Territory, Statistical Division and Subdivision and Statistical Local Area. These statistical divisions and statistical local areas are designed to allow useful comparison of statistical groups over time. Areas encompassing towns are usually set with a buffer zone to allow expansion, to reduce changes in the divisions over time.[47]

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[44] ABS • *Agricultural Commodities* • 7121.0 • 2010-11, p. 31 (Note 14).
[45] In the 2000-01 census the ABS also included user-funded questions on various land management issues. This included questions on pasture establishment, land preparation, fallow land irrigation scheduling, soil conditioners, fertilisers, tree plantings, and fencing; see ABS • *Agricultural Census* • 7 November 2012 [Accessed on 7 November 2012]
http://www.abs.gov.au/AUSSTATS/abs@.nsf/DOSSbytitle/AD7C6DD1D14FB809CA256BD000272737?OpenDocument
[46] ABS • *Australian Statistical Geography Standard (Volumes 1-4)* • 1270.0.55.001-004 • July 2011.
[47] ABS • *Statistical Geography Explained* • 19 November 2012. [Last accessed 19 November 2012]
http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Statistical+Geography+Explained

Most of the published data from the Agricultural Census that is relevant to the vegetable growing industry is released in a small number of ABS reports: Agricultural Commodities, Value of Agricultural Commodities Produced, Gross Value of Irrigated Agricultural Production, and Water Use on Australian Farms. The main report is the Agricultural Commodities report which sets out production and land data for vegetable categories and vegetable growing overall. A complete list of information from the ABS catalogues, including these reports, is contained in Table D.1 in Appendix D. The reports in these catalogues generally consist of a written report containing the relevant data and methodological information, together with spreadsheets of the data called "data cubes". For some data sets broken down by State/Territory or by other variables such as EVAO, the ABS also provide online interactive maps allowing users to quickly get statistics on agricultural activities in each location.[48]

Though the ABS data includes some data on categories of specific vegetables, this categorisation is limited to a small number of types of vegetables. It also does not include a breakdown of data into subtypes of the relevant vegetables classes. This means that many growers will be unable to obtain data from this source that is detailed enough to give them information about the specific vegetables grown in their business. The survey of growers found that the majority of growers chose to access information on specific types of vegetables and that this was a popular class of statistical information. Several growers in the survey and follow-up expressed the desire for more detailed categorisation that is provided in the ABS data.

> **Recommendation 8:** AUSVEG should encourage the ABS to work towards surveys that offer consistent and detailed categories for vegetable growing activities. The categories should include breakdowns according to specific types and subtypes of vegetables. In cases where data on categories is given, the ABS should report data on each of the categories and report sufficient information on any overlaps between these categories to allow calculations for all possible conjunctions and disjunctions of the relevant categories.

The ABS data reports production of vegetables by value and by weight. In many cases growers keep records of these vegetables in units rather than by weight and this was reported to give them difficulties in answering some of the survey questions.

[48] For example, see ABS • *Agricultural Commodities, Australia, 2010-11 (Interactive Map)* • 4 July 2012. [Last accessed on 15 November 2012]
http://www.abs.gov.au/websitedbs/c311215.nsf/web/Agriculture+-+Summary+Map+-+Agricultural+Commodities

The annual Agricultural Survey and Agricultural Resource Management Survey provide smaller sample information on the same data measures as the Agricultural Census. These interim surveys supplement the main census to allow for annual updating of industry data. There is a delay in the ABS data between the administration of the census/survey and publication of the resulting data. For example, the most recent Agricultural Commodities report is the 2010-11 report, which was released in June 2012. This does not fit well with the reported needs of growers since most reported high usefulness for data that is updated promptly. Indeed, during the follow-up interviews several growers reported that the ABS data was not useful to them for this reason — by the time they receive the data it is not useful for their business decisions.

The ABS website provides basic functionality for accessing data. Data is contained in written reports and data cubes which can be accessed by catalogue number. There are some limited interactive maps but these do not have many features. An improved facility for access to this information is a publicly available online facility called HORTSTATS provided by HAL. This facility gives statistical data from the ABS on areas planted, volume and value of vegetable production, and vegetable yields.[49] The statistics are taken directly from the reports coming out of the ABS surveys. The facility can produce time-series plots of ABS data for types of vegetable and localities based on statistical divisions. It can also produce an overall graphical depiction of Australia separated into statistical divisions, with shading indicating levels of the data values in each division. This function is similar to the interactive maps available at the ABS website but the level of detail is greater and it has better functionality.

The available data for the time-series plots on HORTSTATS differs according to the data that is available from the ABS. In some cases the data goes back several decades and in other cases it only goes back a few years; there are several time-series with gaps in the data. In any case, the change in the ANZSIC framework in 2005-06 and the resultant change in the ABS sampling frame means that more recent data is not comparable with older data even when the latter is available. The breakdown of crops is based on the level of detail in the ABS data. There are a large number of crop categories stated in the time-series tool, including many categories that are not in the current ABS data. (Vegetable categories are put together with fruit categories to give wider data for horticultural activities so you need to pick out the vegetable categories.) Since the underlying data uses the categories from the ABS this means that some attempts to

[49] HAL • HORTSTATS Database [Last accessed on 20 November 2012]
http://hortstats.horticulture.com.au/Welcome-Page.aspx

generate time-series plots lead to a blank data set. Nevertheless, this is a convenient facility for accessing historical time-series of ABS data.

> **Recommendation 9:** AUSVEG should consider providing a link for growers to the HORTSTATS database on its website.

In addition to the information in the agricultural section of the ABS catalogues, the ABS also publish information pertaining to other aspects of vegetable farming. This includes data on farm management and climate, water use on farms, and social trends for farming families.

ABS data on foreign trade of vegetables is available through published ABS reports. It is also compiled in the Global Trade Atlas maintained by Global Trade Information Services Inc (GTIS). This is an online database requiring a subscription to access. Data in this facility is taken from the ABS trade reports and put into a database facility allowing searches according to vegetable category. AUSVEG presently sources some of its data from this facility; information from AUSVEG referral is that the cost of this subscription is approximately $25,000 per year.[50] The Global Trade Atlas contains ABS data on foreign trade flows including imports, exports and trade balances. These categories include data on value, "quantity" (by weight) and "unit price" of vegetables (by price/weight). The categorisation of vegetables is done by the Harmonisation System (HS) Code which differs from the ANZSIC classification but is commonly used for foreign trade data. This includes 14 categories of vegetables which are further subcategorised into specific vegetable types or categories of only a few similar vegetables. Data searches from this facility show the level of trade with each different country in the chosen HS category.

A full breakdown of all ABS reports pertaining to the vegetable industry is set out in Table D.1. of Appendix D. This contains some categories of data that are not presently reported on the AUSVEG website. In order to determine whether or not this data is suitable for its Industry Statistics webpage, AUSVEG would need to review the data in conjunction with the present information regarding the needs of growers.

> **Recommendation 10:** AUSVEG should review the reports in the catalogues set out in Appendix D of this report and consider whether any of the data in these reports is suitable for its Industry Statistics webpage.

[50] Information provided to the consultant by Mr Ian James, Vegetable Industry Economist.

5.2. Data available from ABARES

ABARES conducts regular research on the agricultural industry including the vegetable growing industry and releases regular reports with data pertaining to these matters. Some of the reports pertain to the agricultural industry as a whole and other focus on categories within this industry with some reports being available on vegetable growers. A complete list of recent information and reports from the ABARES website is contained in Table D.2 in Appendix D. Most of the data in these reports is sourced from the ABS and various State and foreign government agencies. Some of the data is obtained from surveys conducted directly by ABARES.

ABARES publishes quarterly reports on agricultural commodities which track statistical data on the agricultural industry over a period of six years.[51] These reports make use of ABS data including data on production and farm values. The reports also include price indexes, forecasts and other measures and estimates determined by ABARES which go beyond the data available at the ABS.[52] The reports include net foreign trade data, export and import data, and data on exports to specific countries such as the USA, China and Japan.[53]

In 2006, ABARES conducted a report into the international competitiveness of the Australian vegetable industry.[54] This report includes data on vegetable consumption in Australia, USA and Europe, market channels to consumers, origin of vegetables sold in Australia, production and processing, unit values, farm characteristics, trade and tariffs, and the economic performance of Australian growers. The report is based on a survey by ABARES of a sample of approximately 400 Australian vegetable growers.[55] It gives a broad overview of data relating to comparison of Australian growers with overseas growers and matters pertaining to competitiveness.

ABARES also publish various research reports and conference papers relating to agricultural issues. Some of these contain data and analysis which may be useful on a case-by-case basis. From a search of the ABARES online archive the present consultant was only able to identify one such paper containing potentially useful statistical data, though there may be others. This was a report on weed eradication with data on the effectiveness of methods of eradicating weeds.[56]

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[51] E.g., ABARES • *Agricultural Commodities* • Vol 2(3) • September Quarter 2012.
[52] Ibid, p. 142.
[53] Ibid, pp. 170-172.
[54] Apted, S., Berry, P., Short, C., Topp, V., Mazur, K., and Mellor, T. (2006) *International Competitiveness of the Australian Vegetable Production Sector*. ABARE eReport 06.5.
[55] Ibid, p. 60.
[56] Woldendorp, G. and Bomford, M. (2004) *Weed Eradication: Strategies, Timeframes and Costs*. ABARES.

The most useful recent source of data at ABARES is a collection of reports commissioned since 2005 to look at economic activities of Australian vegetable growers. This work was conducted by ABARES and commissioned by HAL to obtain data going beyond what is available from the ABS census and surveys. The ABARES surveys were funded jointly by HAL and the Department of Agriculture, Fisheries and Forests (DAFF).[57]

Since 2005-06 ABARES has conducted an annual economic survey of the vegetable industry to obtain detailed information on the financial characteristics of vegetable growing businesses.[58] Further surveys continuing this series will be conducted until 2013 under a present project by HAL. The cost of these surveys to HAL is slightly over $300,000 per year.[59] ABARES also has a small amount of data from a survey on Murray-Darling farms, though much of this overlaps with the more general survey of growers. ABARES reports that it has no other data on vegetable growers beyond what was commissioned by HAL. It has presently published five reports on these annual surveys.

As with the ABS surveys, the sampling frame for each survey was taken from the ABSBR, but this was subject to a threshold EVAO of $40,000 — higher than in the ABS surveys. Smaller farms which do not appear on the register would not have appeared in the sampling frame and small farms below the cut-off point for EVAO were also excluded from the sampling frame by the surveyors.

Each of the surveys used a stratified sampling method based on State and EVAO. This means that the surveyors sampled from the frame to obtain a cross-section of farms based on different States and values of the EVAO variable, and then weighted their results to accord with the distribution of these variables. The purpose of this methodology is to reduce variance in the resulting inferences by filtering out the effect of the stratification variables. Sample sizes in the strata categories were chosen using a method for minimising variability of the estimates.[60] In

[57] Note that ABARES is a part of DAFF so that the surveys were effectively partially self-funded.
[58] The most recent report is ABARES • *Australian Vegetable Growing Farms: An Economic Survey, 2009-10* • Research Report 11.8, November 2010. There are five reports in total, from 2005-10.
[59] HAL Project VG10047 is a three year project from 2010-11 to 2012-13 with a cost of $909,045.45; information supplied by Mr Andrew White, AUSVEG.
[60] The method used was the variance-minimising method known as the Delanius-Hodges method; see Dalenius, T. and Hodges, J.L. (1959) Minimum variance stratification. *Journal of the American Statistical Association* **54**, pp. 88-101; Lehtonen, R. and Pahkinen, E. (2004) *Practical Methods for Design and Analysis of Complex Surveys (2nd Edition)*. Wiley: Finland. This method selects sample sizes within each stratum to minimise the estimated standard error for the overall population estimates. The allocation involves a compromise between allocating proportional to the size of the stratum and allocating higher proportions to strata with higher variability of the stratification variable (EVAO).

the later surveys (from 2007-08 onward) the surveyors also adjusted their estimates using benchmarks to ensure that statistical inferences about the total area of vegetables planted and the number of farm vegetables match the totals from other data sources. This was done using a statistical regression method that relates the survey variables with benchmark variables from outside data sources.[61] This later change in methodology was also applied retrospectively to the previous surveys to update their results using the benchmark information. This means that all five of these reports can be compared on a like basis based on the updated figures for the present methodology.

The number of farms in the sampling frame and the number of respondents in the sample are set out in Figure 5.1 below. (Count data for this figure along with information about the survey methodology is contained in Table C.4 in Appendix C.) The count values for the sampling frame and the resulting counts of unsampled farms refer only to those businesses in the ABSBR that were eligible for the survey and met the EVAO threshold. This threshold of $40,000 is higher than the ABS threshold of $5,000 so that the counts in the frame are lower than for the ABS.

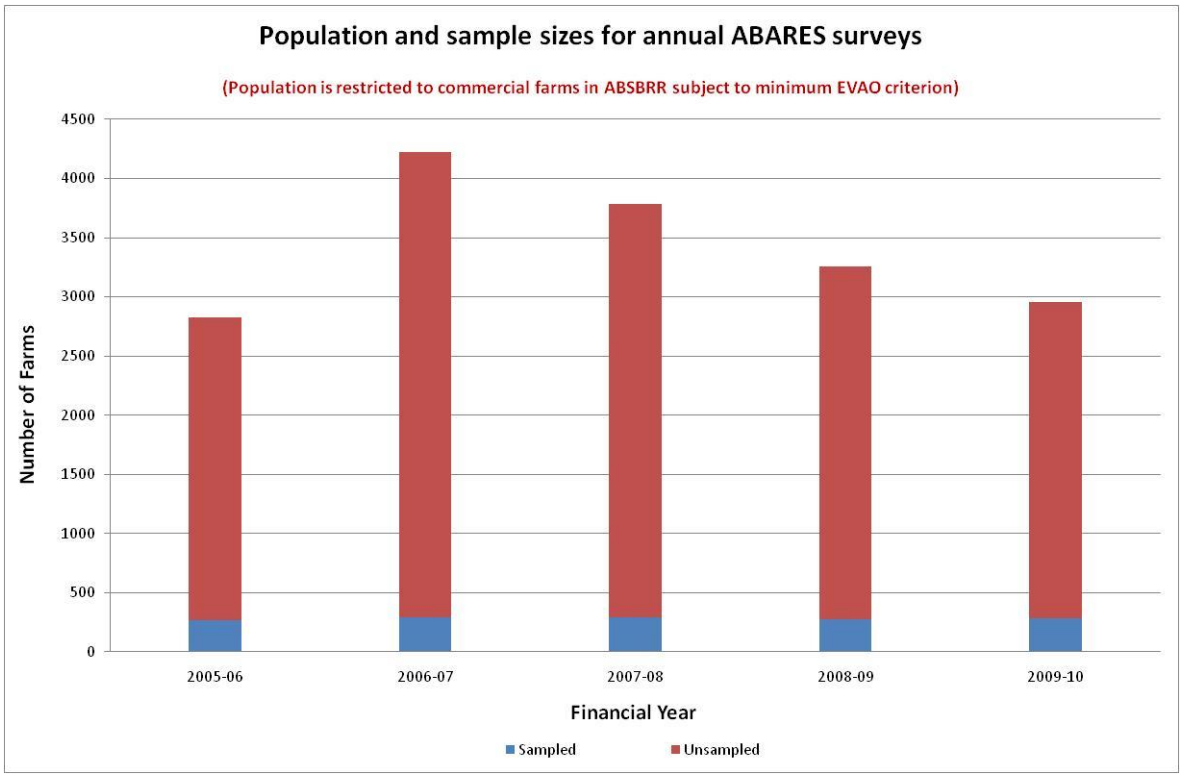

Figure 5.1: Population and sample sizes for annual ABARES surveys

[61] Bardsley, P. and Chambers, R.L. (1984) Multipurpose estimation from unbalanced samples. *Journal of the Royal Statistical Society (Series C)* **33(3)**, pp. 290-299.

The change in eligible farms in the sampling frame is affected by the business count changes in the ABSBR captured previously in Figure 4.3. The present sampling frame has lower counts due to the imposition of the EVAO threshold reduces the number of eligible businesses for the survey. The count values in the ABARES sampling frame shows a decline in eligible businesses since the 2006-07 financial year which is somewhat in accordance with the decline in business counts in the ABSBR (though the present decline is much steeper). The count values in the ABARES frame also begins at an initial low value in the 2005-06 financial year which then leads to an upsurge in the 2006-07 financial year; this is not in accordance with the pattern of business count values in the ABSBR. (The ABSBR counts have a sharp upsurge in the previous financial year due to the change in the ANZSIZ categorisation, but this does not line up with the change in the ABARES counts.) ABARES was asked about this discrepancy and the general pattern of counts in the sampling frame as part of the present project but were not able to provide an explanation within the required timeframe for the project.

The ABARES surveys used face-to-face surveying of the sampled farms. For each sampled farm the surveyors contacted the owner/manager and undertook a survey of various matters relating to their farm operations. Questions were similar from year to year, though not always identical. The survey included pre-interview questions to establish eligibility for the survey, confirm the correctness of the stratification variables, confirm address and location, and check availability of financial and production data.

The main body of the survey included questions on the following areas of interest:

- Vegetable production (products, amount produced, sales, transfers, inventory);
- Labour (family and hired labour, worker status, hours, wages, off-farm work);
- Management (operator's education, spouse's education, government assistance);
- Assets (type and value of liquid assets, land, vehicles, plant, equipment, buildings);
- Liabilities (details of all farm debt);
- Income and expenses (all costs and income associated with vegetable business);
- Farming practice (irrigation, water, chemical use, pests and diseases)
- Business (sale outlets, information, constraints, buyers, future intentions)

Data on these items is compiled into data tables which are broken down by State and by type of vegetable according to the classification previously shown in Figure 2.3. The survey breaks the data down into several different types of vegetables: potatoes, pumpkins, green peas, beans, tomatoes, onions, carrots, cauliflowers, lettuce, broccoli, cabbages and "other vegetables".

5.3. Data available from the APC

Some further reports and analysis pertaining to the vegetable industry are available at the Australian Productivity Commission (APC). These reports do not appear to contain any original data, but they do bring together data and information from other agencies to conduct various types of analysis related to productivity. The reports undertaken by the APC include a research paper on trends in agriculture, a review into regulatory burdens in the agricultural industries, and a report on horticulture. All of these documents are set out in Table D.2. in Appendix D and are available on the APC website.

In 2007 the APC conducted a review into the regulatory burdens on businesses in the "primary sector" including agriculture.[62] This review mostly brings together information on regulatory burdens from other sources; it contains a very small amount of statistical data. (It is notable in the present context that the report noted concerns from growers over the time burden imposed by government surveys.[63])

In 2005 the APC conducted a review of trends in agriculture, containing a substantial amount of economic data on the agricultural industry with some broken down to give information on specific industries including the vegetable industry.[64] This data is sourced from the ABS data sets already mentioned. Data on the vegetable industry includes various output and economic measures including breakdowns of output by State, contribution to total agricultural output, growth rates, exports, farm numbers and employment data. Some of the data combines fruit and vegetable growing but some treats vegetable growing as a single category.

The APC also has some statistical data contained in a 1993 report on horticulture.[65] This is now quite dated and would probably be of little use to growers. Moreover, data in this report is available from other agencies; it is sourced from a variety of organisations including the ABS, ABARES and FAO. The report contains production, consumption and economic data for the horticulture industry with a small amount of data specific to vegetable production.

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[62] APC (2007) *Annual Review of Regulatory Burdens on Business: Primary Sector*. 5 November 2007. http://www.pc.gov.au/projects/study/regulatory-burdens/primary-sector
Note that although this report is titled as an annual review, these are conducted on a rolling basis so that, to date, there has only been one review of the primary sector, including agriculture.
[63] Ibid, pp. 140-141.
[64] APC (2005) *Trends in Australian Agriculture* • 5 November 2007. Research Paper. http://www.pc.gov.au/research/commission/agriculture
[65] APC (1993) *Horticulture – Industry Commission Report* • Report No 29.

5.4. Data available from the FAO

The ABS and ABARES data focus on industry statistics for Australia and only include data for foreign countries to the extent of reporting data on international trade with between Australia and other countries. As part of its research activities, the Food and Agricultural Organization (FAO) at the United Nations collects data from statistical agencies in countries around the world. Australian data is sourced from the ABS and data from other countries are sourced from the relevant government statistical agency in each country. This data is compiled and presented in various reports and databases that are available to the public at no cost to the user. The FAO provide several online database facilities with interactive features allowing users to select a desired data set and either export it to a spreadsheet or display it on a time-series plot or spatial map.

The main resource available at the FAO is a publicly available online database called FAOSTAT, with statistical data on land use, production volumes and values, and exports/imports.[66] This database can be searched or browsed by country or by types of crops and data. Data can be exported to spreadsheet form and simple forms of statistical analysis can be performed online.[67] Time-series plots and bar charts of the data are automatically displayed for the user and these can be downloaded from the website. The breakdown of crops in the data is at a similar level of detail to the ABS data though these are also formulated to encompass statistical data from countries around the world. Some categories are more detailed than in the ABS data, though it is not clear how these categories are resolved, since data is sourced from the ABS.

FAO also provides another online database facility called Agro-MAPS which allows the user to generate an interactive spatial map of the world with coloured shading for vegetable growing activity. The interactive map allows users to scroll and zoom-in to target areas of interest and quickly change the relevant vegetable type, data year or data category. The map allows the user to add or remove national boundaries and land cover and usage graphics. The entire website is actually quite impressive and contains many excellent interactive tools. It can be regarded as an example of best practice in the field.

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[66] FAO • FAOSTAT Database [Last accessed on 20 November 2012] http://faostat3.fao.org/home/index.html#HOME

[67] This includes generating simple descriptive statistics, correlation analysis and linear regression. While the facility is highly impressive it is likely that users would be better served to export data into an Excel spreadsheet and then use the data analysis functions of this program, since these are far wider than what is available on the FAOSTAT website.

Because data is sourced from government statistical agencies in each country this data source would not enable growers to get any statistical data about Australia that is not already available at the ABS. However, it is far more user-friendly than the ABS website. Moreover, it would allow growers to access statistical data pertaining to growers in other countries. The FAOSTAT database is also augmented by a recurring (annual/biennial) statistical yearbook summarising data on matters pertaining to global food production.[68] (This does not go into sufficient detail to identify data specific to vegetable growing.)

The FAO conducts a world census of agriculture every ten years, though there is a substantial lag in the publication of results. The last census available is the 2000 world census.[69] For vegetable growing operations in Australia this report contains information on land use, production and land area data for temporary and permanent crops. Data on other countries differs according to what is available from the relevant statistical agencies but tends to have a similar focus on land use and production. The 2010 world census is presently being undertaken as is due to be completed by 2015.[70] The FAO also has a database on water statistics called AQUASTAT.[71] This contains some data on water resources and use in Australia and other countries, though this is aggregated data that does not allow focus on the vegetable industry.

Information available from the FAO is mostly information pertaining to other countries. Data from Australia is limited to a fairly small amount of information sourced from the ABS. We have already seen from our survey of growers that data on overseas vegetable growers is a low priority among growers in Australia in terms of its usefulness. Nevertheless, approximately one-third of growers reported that this category of data was useful.

> **Recommendation 11:** AUSVEG should consider providing a link for growers to the FAOSTAT database on its website. AUSVEG should also take note of this facility in cases where comparative analysis between the Australian industry and countries is required. This facility can be regarded as an example of a well programmed data facility with excellent functionality.

[68] FAO (2010) *2000 World Census of Agriculture: main results and metadata by country (1996-2005)*. Food and Agriculture Organization of the United Nations: Rome.
[69] FAO (2012) *Statistical Yearbook 2012*. Food and Agriculture Organization of the United Nations: Rome.
[70] FAO • *World Program for the Census of Agriculture 2010* •2012
http://www.fao.org/economic/ess/ess-wca/wca-2010/ru/
[71] FAO • AQUASTAT Database [Last accessed on 20 November 2012]
http://www.fao.org/nr/water/aquastat/main/index.stm

5.5. Data available from private data agencies

Demand-side data for vegetable consumers is available from various market analysis companies such as AC Nielsen, Freshlogic and IBISWorld. These companies provide reports and data at a subscription cost and also provide data collection and research services. We will consider each of these sources of data in turn.

AUSVEG presently source some of its data from AC Nielsen and make reports of this data available on the member-access pages of its website.[72] These reports set out sales data for various types of vegetables including demographic information about consumers buying each kind of vegetable. The reports also include demographic information on household type, number of family members, and household income.

Consumption data from AC Nielsen is obtained under their Scantrack program for retailers and their Homescan program for consumers. The Scantrack program operates on the retailer by tracking sales made at the store. The participating retailer provides sales data to Nielsen from their own scanning systems in order to obtain useful data related to their business.[73] The Homescan system operates by inviting consumers to sign up to track their purchasing at all stores. Nielsen sends participating consumers a handheld scanner which they use to scan the barcodes of their purchases and manually enter the price of their goods. The consumer remits this data back to Nielsen and in return for their labour they earn points that can be redeemed for a selection of goods provided by Nielsen.[74] In order to control costs, the goods earned are of quite low value relative to the amount of time spent scanning and remitting data, so Nielsen also attempt to make the program attractive to consumers by appealing to consumers to "have your say" and influence the goods provided by retailers.

In any sampling mechanism of this kind there is a danger that participating consumers might differ systematically from the population and this may mean that the sample data of their buying habits is not representative of the wider population. To deal with this, Nielsen collects covariate data on the demographic and household characteristics of its participating consumers and uses statistical regression techniques on this data to relate household characteristics to

[72] AUSVEG • *Nielsen Vegetable Market Reports*. [Last accessed 20 November 2012] http://ausveg.com.au/intranet/vegetable-market/nielsen/nielsen.htm
[73] http://nz.nielsen.com/products/crs_scantrack.shtml
[74] http://www.nielsen-onlinereg.com/?cpid=1C01C0

reported expenditures.[75] Given outside knowledge of the household demographics in the population this then gives a basis for estimation of the consumption for the whole population. (Even after this there is still a danger of a residual relationship between consumption decisions and participation in the sample group and this can still lead to bias in the estimates.) The data reports supplied by AC Nielsen do not have details of methodology or sample sizes.

In addition to the AC Nielsen vegetable reports, AUSVEG also presently sources some of its data from Freshlogic, through a publication called Veginsights.[76] This is also demand-side data for retailers, wholesalers and the rest of the supply chain. These reports set out sales data for various types of vegetables including demographic information about consumers buying each kind of vegetable. The reports include demographic information on household type, and also include information on preparation of vegetables for consumption, advertising and other retail matters. Consumption data from Freshlogic is obtained in a similar way to consumption data from AC Nielsen. Freshlogic operates using a docket system where participating consumers supply their purchase dockets to Freshlogic instead of scanning information in with a portable scanner. This information is combined with demographic, attitudinal and health information in the same kind of way as in the AC Nielsen data, allowing an estimate of overall consumption outcomes for the population (i.e., via statistical modelling relating the consumption activities and demographic information).

Another source of data on the vegetable industry is IBISWorld, another large private provider of industry-based research reports. IBISWorld have several reports pertaining to the vegetable industry and containing data on financial matters within the industry. The reports issued by this provider concentrate on assessment of financial and economic matters. These reports set out data on industry performance, products and markets, competition and barriers to entry, operating conditions, and financial information about major companies in the industry. There are also risk rating reports that assess volatility within the industry and other measures of risk.

Most of these IBISWorld reports are arranged to correspond to the ANZSIC categories used in the ABSBR. There are reports on vegetable growing (under cover and outdoors) and reports on production, wholesaling and retailing of fruit and vegetables. The reports do not cite source

[75] Explanation of this kind of methodology is set out in Nielsen (2010) *Nielsen Consumer Buying Power Methodology*, September 2010. This particular document refers to the consumer buying program in the US, but it is likely that the same techniques are used in all similar surveys.
[76] Freshlogic • *Veginsights* • [Last accessed 20 November 2012]
http://ausveg.com.au/intranet/vegetable-market/veginsights-weekly/recenteditions.htm

documents for the data and it is only sourced back to the general webpage for IBISWorld itself so it is not clear exactly where the data has come from.[77] There is also no discussion of any independent surveying by IBISWorld or any discussion of methodology in the documents. Some of the figures used come from the ABS, but a fuller attribution of sources is not possible with the information available. In any case, the general industry reports provided by IBISWorld provide useful discussion of data in a form that is not available at the ABS.

In addition to industry reports classified by ANZSIC category, IBISWorld also have reports on various specific companies operating in the vegetable industry. These reports contain more detailed financial information and characteristics of major companies in the industry, such as Moraitis Pty Ltd, Simplot Australia (Holdings) Pty Ltd, McCain Foods (Aust) Pty Ltd and Sydney Markets Ltd. (There were 58 company-specific reports available in an IBISWorld search of "vegetables" – the present author has not been able to verify whether all of these are relevant to vegetable growing, but some are. These reports appear to cover the main large companies in the vegetable industry as well as large companies operating in the food industry more widely.)

IBISWorld industry reports are presently available at a cost of $845 per report and the company reports are presently available at a cost of $65 per report.[78] Reports are also available under a membership subscription.[79] Some of the information in the industry reports may be useful to growers or to AUSVEG but the company reports are less likely to be useful. Access to IBISWorld reports is subject to contract with IBISWorld and it is unlikely that AUSVEG could secure a form of access that would allow it to provide these reports to growers. However, there would be no impediment preventing AUSVEG from purchasing reports for itself and using the information in these reports to assist in giving its own commentary on the state of the industry to growers.

> **Recommendation 12:** AUSVEG should continue to provide demand-side statistics and reports to growers. AUSVEG should also consider purchasing industry reports for its own information. It is unlikely that these reports could be given to growers, but AUSVEG could use the information in the reports to assist its advice on the state of the vegetable industry and give its own advice to growers on these matters.

[77] See e.g., IBISWorld (2012) *Vegetable Growing (Under Cover) in Australia*. Industry Report A0122, p. 29.
[78] http://www.ibisworld.com.au/cartv2/purchaseoptions.aspx
[79] http://www.ibisworld.com.au/about/enquiry/?sub=1

5.6. Data available from vegetable markets

Several vegetable markets around Australia supply market reports with data from the market. These reports can be daily, weekly, monthly or annual reports, and some markets also provide historical reports. Most reports are compiled by private agencies acting for the markets and the specific service that is provided differs from market to market. Most provide a subscription service allowing growers and other market participants to order emailed or faxed reports of market activities and outcomes.

The specific information available in market reports differs according to the particular market and report provider. However, these reports generally set out information on each specific type of fruit or vegetable sold at the market. For each product type there is qualitative information on levels of supply, demand and carryover, and quantitative estimates of the range of prices and quantity of sales. The quantitative information on prices and sales is usually expressed as an estimated range of values while the qualitative information for levels of supply, demand and carryover are usually expressed in terms of general descriptions (e.g., demand may be described as "good", "fair", "low", "high", etc.) Some reports also provide information on the origin of the products sold, usually expressed by State/Territory or region, or expressed as imported if the product is from overseas.

A list of vegetable markets in Australia can be found in the market directory of the Australian Farmers Market Association (AFMA); this list contains 157 markets.[80] Several of these markets have facilities for market reports. These reports give a very timely source of information for growers. Daily reports are compiled each day and are available quickly after data is compiled. Corresponding weekly, monthly and annual reports are also available quickly after the data is compiled. Evidence from interviews of growers suggested that some growers rely heavily on these reports as a timely source of pricing and market information for making growing and harvesting decisions. Some growers reported finding these reports useful but others reported that they do not trust the accuracy of the information in the reports.

Present prices for market reports vary depending on the particular market and the type of report required. Reports can be provided for specific vegetables or for a list of all vegetables sold at the markets. Individual costs for the reports are low, but bulk ordering of reports from a multiple markets for all types of vegetable would probably be prohibitive in cost if done over a

[80] See http://www.farmersmarkets.org.au/markets [Last accessed 20 November 2012]

long period of time.[81] Aside from cost issues, most of the market reports may only be ordered and accessed under the condition that they not be reproduced, published or used to make any derivative work or database of information. This greatly limits the availability for purposes of providing statistical data to growers and means that AUSVEG probably would not be able to make use of this source of data to provide reports or statistics.

> **Recommendation 13:** Reporting of market information from vegetable market reports is unlikely to be feasible due to cost and availability constraints.

5.7. Data available from other agencies

The preceding data sources give a sizable repository of data on the vegetable industry. Primary supply-side data comes from the ABS and a small amount of supplementary information comes from ABARES. Primary demand-side data comes from private agencies that conduct surveys of sales from retailers to consumers. Data in some secondary reports is duplicated from ABS data but often it is put into a form which is more user-friendly than in the ABS data system or in a way that elucidates its meaning better than in the ABS reports.

All of the data sources we have considered so far are set out in more detail in Tables D.1 and D.2 in Appendix D. The first table sets out ABS data from its catalogue system that pertains in some way to vegetable growing. The second table sets out data from other agencies that pertains to vegetable growing. In addition to these sources of data the author also investigated potential sources of data at other agencies but without discovering any available data source that would add to this stock of data in a substantial way.

The present author investigated possible data sources at a number of other agencies including the CSIRO and ATO. The CSIRO did not have any data of use to vegetable growers as all of their agricultural activities involved more detailed scientific problems. We have already noted that the ATO is the source of the business register used as the basis of the ABSBR. This data source is

[81] It is not possible to give a cost estimate here without a more detailed investigation into this issue, which would probably require an entire research project in its own right. To get a sense of the individual prices of reports, a daily market report for vegetables sold at one of the markets is usually around $3-10 as a one-off cost, and weekly, monthly and annual reports are usually around $10-20. Some markets provide reports at a cost based on the number of types of vegetables included, and this is usually done on a scale with diminishing costs per crop category. Historical reports for summarised data are sometimes cheaper than the more detailed reports.

not available outside of government agencies since it includes information on specific businesses.

The only other potentially useful source of data pertaining to the vegetable industry available at the ATO is published taxation data relating to businesses in the agricultural industry. The ATO publish an annual report on taxation statistics which contains statistical data on taxation for the whole of Australia.[82] This data is broken down according to ANZSIC categories but only to the level of the agricultural sector as a whole. This means that there is no data specific to the vegetable growing industry within this classification, but it is possible to obtain results for the agricultural industry. The report contains data setting out counts of taxable entities, income, taxation liability, types of tax paid, concessions and rebates, pay-as-you-go withholding and other taxation matters. This is unlikely to be very useful but may be of marginal interest and so it has been included in this report.

[82] ATO (2012) *Taxation Statistics 2009-10*. Australian Taxation Office: Canberra.

6. Assessment of data reliability

One of the goals of this project is to assess the available sources of data to get a sense of their likely accuracy and reliability. We have already made reference to the methodology by which this data is collected and we have examined the sampling frame for the core data in detail. We have also obtained some information on counts in the sampling frame and sample sizes in the survey. Finally, we have obtained anecdotal evidence from discussions with growers and other industry participants about their data reporting practices and their assessment of the reliability and usefulness of different sources of data.

To assess the reliability of the available data sources it is prudent to assess the possible sources of error in statistical inference problems using data. By "error" we refer here to any disparity between the reported estimates in the data and the actual state of the industry. (It is important to note that some sources of error in sample surveys are unavoidable. Hence, when we refer to "error" we are not actually referring to any shortcoming of the survey analysis, nor any mistake by the surveyors. We are referring only to a disparity between the desired information of interest and the reported outputs in the data. Since these are usually expressed as estimates subject to uncertainty there is already an acknowledgement that these outputs are imperfect.)

The sources of error in a statistical error are illustrated in Figure 6.1 below.[83] This shows the process of information flowing from the group of all vegetable growers down to the outputs of the survey, which in this case are estimates of quantities associated with the sampling frame. Each part of this process involves the possibility of error, in the sense of imposing some effect that causes a disparity between the reported estimates and the actual state of the growers that are of interest. We will consider these sources of error in the following categories:

- Sampling frame error;
- Sampling error;
- Non-response error;
- Measurement error;
- Processing error; and
- Model error.

[83] Discussion of sources of errors in surveys can be found in Groves, R.M. (1989) *Survey errors and survey costs*. Wiley: New York; Lessler, J.T. and Kalsbeek, W.D. (1992) *Nonsampling error in survey*s. Wiley: New York. The present treatment is tailored to the situation of sampling vegetable growers and focuses on the main possible sources of error in this case.

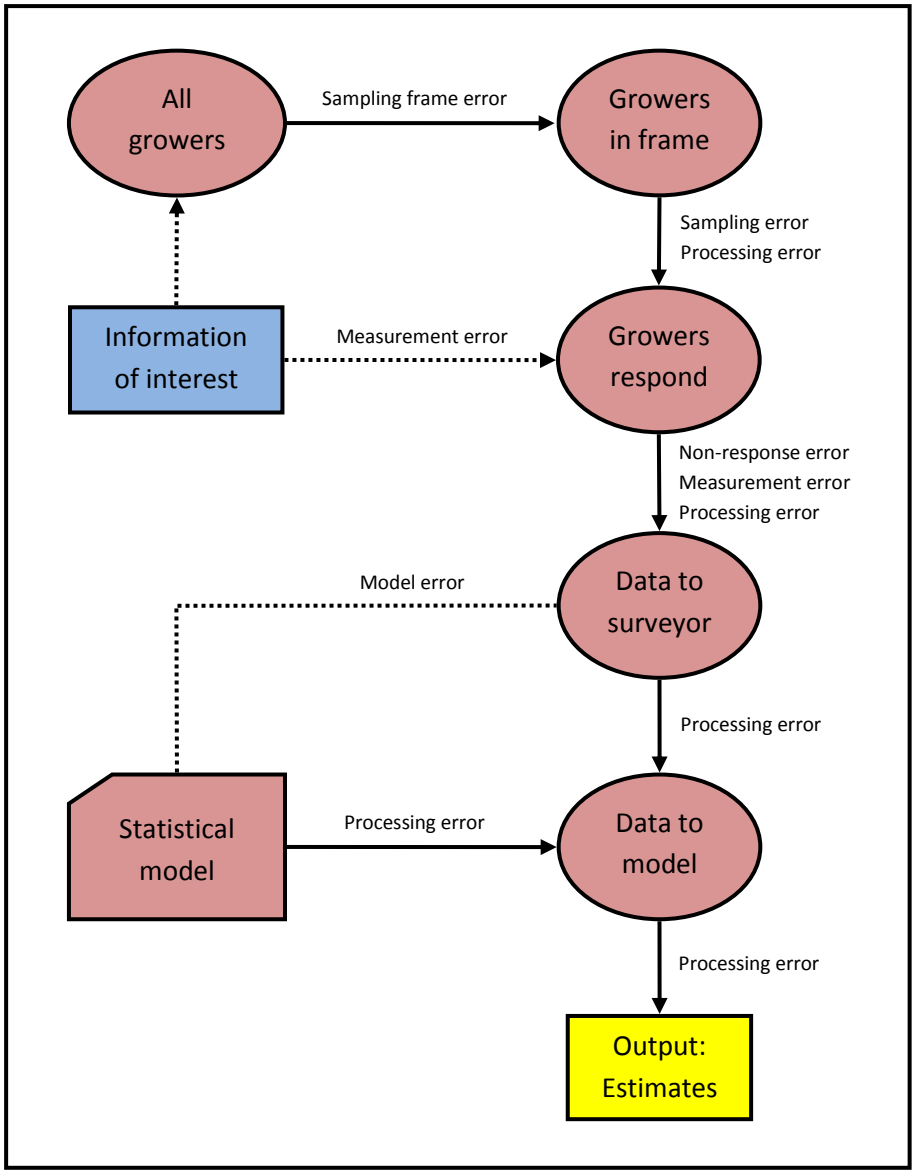

Figure 6.1: Sources of error in statistical estimates from grower surveys

This flow diagram shows the full path of the initial information of interest to the final output in the statistical inference problem. The full path of information begins in this figure in the blue box as information applying to all growers. The group of all growers in the top-left is reduced down to a smaller group of growers who are identified in the sampling frame for the survey. In the case of the agricultural surveys undertaken by the ABS and ABARES this transition would represent the reduction down to business units on the ABSBR that meet the minimum EVAO threshold. The error caused by the disparity between these two groups is referred to as sampling frame error.

From the growers in the frame the surveyor then selects a sample but some of the selected sample participants choose not to respond to the survey when solicited to do so. This causes a further disparity between the observed group and the group in the sampling frame which we refer to as non-response error. Unlike sampling error, this form of error does not average out to zero over random samples. Non-response error can introduce a systematic bias into the results which is not usually present in sampling error occurring from random sampling.

Having decided to respond, the group of respondent growers collect the information needed for the survey in order to report it to the surveyor. Any disparity between the true information and the information they collect is referred to as measurement error (i.e., the grower has measured the information incorrectly). The respondents then give this information to the surveyor. Since growers can give incorrect information to the surveyor this creates another disparity which is also called measurement error. (We refer to this as "error" even if the grower intentionally gives incorrect figures for some reason. This is only likely to occur in a compulsory survey since there is rarely an incentive to voluntarily give intentionally false information.)

Having obtained data from the respondents growers the surveyor chooses a statistical model to analyse the data. (In practice this might well have been done before getting the data though this depends on the analysis.) This model consists of a set of assumptions about the data process together with their logical implications as determined by the mathematics of statistical theory. To the extent that these assumptions fail to accord with reality this introduces a further source of disparity between the true state of the information and the final output which we refer to as model error. Having chosen the model the surveyor (or possibly a separate analyst)[84] feeds the received data into the model and produces estimates of the information of interest as an output, shown in the yellow box in the bottom-right of the figure.

The remaining source of error which we have so far overlooked is the ever-present possibility of incorrectly processing the data or model in any step on this pathway involving some recording or calculation of required information. This can occur in the initial selection of the sample from the sampling frame, the passing of data from the respondent to the surveyor, the application of the data into the statistical model or the calculation of output from the model.

[84] If the surveyor and the analyst are separate people then, technically speaking, this introduces more pathways with more possibilities of error as information is passed from one person to another. We ignore this here since our goal is simply to set out the types of error that are possible rather than exhaustively identifying every transition in which these errors can occur.

6.1. Assessment of data reliability for supply-side data

We now apply this consideration of possible sources of error to the present situation involving sampling of data from the ABSBR in the agricultural surveys conducted by ABS and ABARES. These are supply-side studies, insofar as their focus is on the production of vegetables and activities of growers rather than the purchasing and consumption decisions of consumers. The present analysis will give us an indication of the most likely sources of error in the ABS and ABARES data and the reliability of this data. To do this we consider the transitions occurring in Figure 6.1 and set out the nature of each type of error that can occur in this context.

Sampling frame error (also called **coverage error**) occurs when there is a disparity between the sampling frame and the population of interest. We take the population of interest to be all vegetable growers operating in Australia that are subject to the National Growers Levy. We have already noted in previous chapters that it is not possible to identify all growers in this population, nor even the exact number of growers in this population. Sampling frame error would be present in all of the data sources we have discussed since the sampling frame for the surveys is only a partial list of all vegetable growers of interest. The base for the sampling frames is the ABSBR, which only includes growers that operate using one or more registered ABNs. For each of the surveys discussed this is further restricted by removing growers that do not meet the threshold level for EVAO. This means that the sampling frame used in the surveys will differ from the population of interest by excluding small growers that do not appear on the ABSBR or which do not meet the requirements for the particular survey.

It is not possible to measure this source of error without the capability to look at the population of interest directly, and so it is inherently difficult to judge. However, we may reasonably stipulate that the removal of smaller growers will tend to bias the resulting group systematically in a way that favour characteristics found in larger growers. We have already seen some of these characteristics in our survey of growers and so we may imagine that these characteristics may be slightly overstated due to sampling frame error. Since there would not be many growers who are not in the ABSBR and smaller growers will have a small contribution to the total output of the industry this means that we would expect only a very small amount of sampling frame error. For the ABS surveys the EVAO threshold is set to $5,000 so there would not be much additional exclusion. For the ABARES surveys the EVAO threshold is set to $40,000 so there is more exclusion, and a correspondingly greater likelihood of sampling frame error.

Sampling error occurs when data from sample of respondents is used to draw inferences about the state of a wider group, such as the total sampling frame. This occurs whenever the sample size of all respondents is less than the total group of interest to the surveyor. This is the case in all surveys and even in a census, though it is less of a problem in the census since the response rates are usually high. Unlike other forms of error, the sampling error can usually be estimated on the basis of statistical theory based on the randomisation mechanism and the size of the sample. This gives values that measure the likely disparity between the reported estimates from the sample and the true state of the larger group. The capability to measure the likely amount of sampling error comes from the random sampling mechanism used in these surveys.

In the present case the data reports include estimates of the "standard error" of the estimates, which can be used to find the likely amount of sampling error. For estimating the average of a particular quantity aggregated over all units in the sampling frame it is possible to determine "confidence intervals" for the true values based on the standard error and sample size.[85] The interval will be narrower (i.e., more accurate) when the standard error estimate is smaller and wider (i.e., less accurate) when the standard error is larger. More information on the width of the intervals is given in Appendix D. As a general rule of thumb the reader may note that once the sample size reaches a moderate size (even 20-30 data points is usually enough) the length of the confidence intervals becomes roughly proportional to the size of the standard error measure (though this measure also reduces as the sample size increases).

The reported standard errors are presently ambiguous since they do not specify whether they are calculated for inference to the average values in the specific population under consideration or to the "parameters" representing the expected value in the statistical model. The former is more useful in the present case and requires the inclusion of a "finite population correction term" into the standard error measure. The statistical reports do not specify whether this term is included in the standard error measure or not. (Standard error measures in this field of statistics may be of either kind and there is no set standard here. Sometimes they include the correction term and sometimes they do not. However, it is useful to specify which version of the standard error is reported.) ABARES have confirmed that their reported standard errors do not include the required correction term for inference to a finite population. The present author has not been able to obtain this information from the ABS within the project timeframe.

[85] Since these inference problems involve known population totals one would also use the population total to calculate the "finite population correction term" for the confidence interval. ABS and ABARES both advised that this correction term was not included in the reported standard errors in their reports.

Recommendation 14: In consultation with the ABS and ABARES, AUSVEG should enquire into the standard error measures presented in the statistical reports to ensure that the appropriate correction term for inference to a finite population is included (either in the standard error measure or as a separately reported term). This would require technical consideration from the ABS and ABARES as to the best method of presentation of the relevant statistics.

For the ABS data the sample sizes for the various estimates were large in the censuses and so the amount of sampling error would be likely to be small. The sample sizes used in the surveys were smaller and so the amount of sampling error would be likely to be larger. In both cases the sample sizes in most categories were sufficiently high to ensure that the length of confidence intervals for the unknown quantities of interest would be roughly proportional to the standard error measure given in the report. The reported estimates from the most recent agricultural census mostly have standard error values that are less than 5% of the estimated quantities, which is a low value. (With a 5% standard error measure a 99% confidence interval would range approximately ± 13% so long as there was a reasonable sample size.) This means that we would expect the amount of sampling error to be low for low measures of the standard error and high for high measures.

Non-response error occurs when a participant that is sampled by the surveyor fails to respond to one or more items in the survey, or fails to respond to the survey at all. This usually imposes a "non-ignorable" form of error, in the sense that non-respondents cannot be regarded as being the same as those that were not sampled in the first place. The reason is that the characteristics of survey participants may be related to their propensity to respond to the survey, leading to a systematic difference between non-respondents and non-sampled units. This can produce a particularly nasty form of error which biases the inference based on the difference between respondents and non-respondents.

In the present case there is evidence that vegetable growers that are likely to respond to surveys differ systematically from those who are unlikely to respond. The data from the survey of growers showed a preponderance of larger growers that was not from the original sampling frame, suggesting that larger growers are more likely to respond to this kind of survey. This might be expected to also occur in other surveys including those run by the ABS and ABARES. If so, this would impose some potential bias in the process since larger growers also have different characteristics of interest than smaller growers.

In the surveys conducted by ABS and ABARES the non-response for sampled participants was quite low for the census and surveys. (In a census all growers are part of the desired sample so all missing growers are non-respondents of this kind.) The ABS and ABARES attempted to correct for non-response by using EVAO and State as covariates to predict the characteristics of the non-respondents using imputation techniques.[86] This involves estimation techniques which add some variability to the analysis but partially compensate for the non-response error by using data to predict their characteristics.

Whether or not a biasing effect would remain would depend on the degree to which these covariates relate to the propensity to respond to the survey. If these are good predictors then these statistical techniques will work well and the amount of non-response error will be reduced. In the case of ABS and ABARES data the covariates chose included the EVAO measure and so this would compensate for the difference between larger and smaller growers. It is not possible to ensure that no differences remain between the respondent and non-respondent population since other unknown covariates (called lurking variables) could still be present. If lurking variables have been eliminated then this form of error would be low.

Measurement error occurs when there is a disparity between some aspect of the actual state of a grower's operations and the information reported by the grower to the surveyor. This would include cases where growers have difficulty accurately calculating data for their own operations or when they otherwise report incorrect data to the surveyor, either intentionally or unintentionally. This source of error is inherently difficult to judge since it cannot be detected in the recorded data without some form of audit using another source of information.

In regard to measurement error by respondents, the ABS note that this "...can be introduced if the respondent does not understand the question, or does not know the correct information about other household members. Self-enumeration carries the risk that wrong answers could be given, either intentionally or unintentionally."[87] This would apply in the ABS and ABARES surveys. Interviews with growers and other industry stakeholders gave anecdotal reports that some have difficulty calculating the required information for the ABS and ABARES surveys and a small number do not take care in their survey responses or do not trust the surveyor sufficiently well to be forthright in their responses. Any of these factors would result in a measurement error problem that would make the survey data less reliable.

[86] ABS • Census Dictionary (reissue) • 2901.0 • 2006, p. 15.
[87] ABS • Census Dictionary (reissue) • 2901.0 • 2006, p. 14.

If the anecdotal reports of growers and other stakeholders are accurate and representative of statistical practice in the industry then this may be a substantial source of error in the industry data. (To put things simply, you can only get out what you put in!) Indeed, aside from sampling errors, which are already quantified in the standard errors in the reports, this is probably the largest source of error in the reported data. Any attempt to improve the ABS data for vegetable growers should focus on this source of error.

> **Recommendation 15:** In consultation with the ABS and ABARES, AUSVEG should consider strategies for encouraging growers to improve the accuracy of data they give in the agricultural census and surveys. This should focus on attempts to engage with the small number of growers who do not give accurate data. AUSVEG should also encourage the ABS to review the questions in its agricultural surveys to ensure that they correspond well to the practices of growers and are not unnecessarily difficult for growers to answer. AUSVEG should obtain and review the questions in the Agricultural census and surveys with a view to determining whether or not these accord with the accounting practices of growers.

Model error occurs if the model assumptions of the ABS and ABARES do not hold. The models used by these agencies are standard statistical models with fairly simple and weak assumptions. The sampling model for estimating the true mean of the population characteristics only requires an assumption of random selection of the sample from the sampling frame. No distributional assumption is required in this part of the model so long as there is a reasonable number of data points (even 20-30 is usually enough).

One part of the model where more tentative assumptions are required is in the linear regression used to adjust for benchmarking. This model form involves distributional assumptions that may not be satisfied in some cases. It is possible to perform diagnostic tests for these assumptions. The present author was unable to obtain this information in the time allocated for the project and was unable to find out what diagnostic tests were performed in the surveying work. In any case, the methods used by the ABS and ABARES are standard statistical models that require assumptions that are either quite weak or else empirically testable. Assuming that the ABS and ABARES have implemented the models and diagnostic tests correctly it is unlikely that model error would be a large factor in the surveys.

Processing error occurs when there is a disparity between information at any point where this is transferred to a new record or in or out of a statistical model. This would include cases of data entry errors, coding errors or editing errors by the surveyor. The ABS adopts quality control procedures to check coding entries and reduce processing errors to an acceptably low level. Data are put through a series of automated checks and a random sample of automated code is checked manually by clerical staff.[88] Data are also subject to logical checks and edits.[89] This source of error is difficult to judge from outside the surveying organisation since it cannot be detected in recorded data without some form of audit. The checks imposed by the ABS are in line with techniques suggested in the statistical literature but it is not possible for the present consultant to assess the effectiveness of these procedures. In any case, processing error is usually quite a minor part of the error in a statistical survey, and since checks have apparently been imposed by ABS it is likely that this source of error would be very small.

Table 6.1. Summary of sources of error in supply-side data

Frame error	• Small loss of coverage of vegetable growers in ABSBR. More loss of coverage imposed by EVAO threshold in sampling frame. • ABS use a low threshold ($5,000) so frame error is likely to be very small. ABARES use a higher threshold ($40,000) so frame error is slightly larger. Effect is to bias data towards characteristics of larger growers.
Sampling error	• ABS and ABARES have reported standard error measures in the reports from their survey data (measured as percentage of estimate using RSE). • For reasonable sample sizes (even 20 or more data points should do) the length of confidence interval should be approx. fixed proportion of standard error measure. Amount of sampling error will vary according to this.
Non-response error	• Both ABS and ABARES use statistical techniques to impute missing values. Effectiveness depends on lack of lurking variables affecting responses. So long as the covariates used in the imputation are informative this method will give unbiased results. If not there may be systematic error. • Still have greater variance due to non-response and this adds to error. Since response levels were reasonable, non-response error should not be too high.
Measurement error	• Anecdotal evidence suggests that most growers do their best to give accurate data on the surveys and appreciate the importance of giving good data. • Some growers have difficulty calculating accurate measures for surveys. A small number of growers are not willing to give accurate data. This is likely to be a large source of error in the surveys.
Processing error	• ABS use checks and safeguards against processing errors. Conduct checks of data including checks of random samples. • This is likely to be a very small source of error in the surveys.

[88] ABS • Census Dictionary (reissue) • 2901.0 • 2006, p. 15.
[89] ABS • Agricultural Census: ABS Views on Content and Procedures • 7103.0.80.002 • 2010-11, Ch 2.

6.2. Assessment of data reliability for demand-side data

We now apply consideration of possible sources of error to the surveys conducted by Nielsen and Freshlogic. These are demand-side studies, insofar as their focus is on the purchasing and consumption decisions of consumers. The present analysis will give us an indication of the most likely sources of error in the Nielsen and Freshlogic data and the reliability of this data. To do this we will again consider the transitions occurring in Figure 6.1 and set out the nature of each type of error that can occur in this context.

In the context of the demand-side surveys there is some ambiguity in demarcating the particular sources of error. The main potential source of error comes from the fact that much of the data for the surveys comes from the reported purchases of consumers that sign up to the programs. Error arising from this can be considered either as sampling frame error (if one considers the frame to consist of these consumers) or as sampling error (if one considers the frame to include all consumers with these consumers being the sample). We will take this to be a form of sampling frame error in the present analysis. Since our present interest is only in assessing the overall reliability of the data this ambiguity is not relevant to our present inquiry.

Sampling frame error occurs here from the fact that the Nielsen and Freshlogic surveys use consumers that sign up with these agencies to have their purchases tracked. This is referred to as self-selection in the survey, meaning that the inclusion of a consumer in the observed sample group is dependent on the choice of the consumer rather than the surveyor. We take the population of interest to be all consumers in Australia, which is a wider group than those that participate in the surveys. The consumers that sign up to give data to these agencies would be likely to differ systematically from the population of interest. Nielsen and Freshlogic deal with this at the inferential level by using demographic information from the observed consumers as a basis to calibrate their estimates to apply to the population as a whole. This technique relies on these chosen demographic characteristics being sufficient to estimate the propensity-to-respond to the invitation to participate. If there are remaining unobserved factors affecting the propensity-to-respond (called lurking variables), this would mean that the attempt to calibrate to avoid error would not be entirely successful.

Sampling error occurs from the fact that the participating group are only a sample of the overall population of consumers. The degree of sampling error from this would depend on the sample sizes in the relevant surveys. The reports from Nielsen and Freshlogic that appear on

the AUSVEG website do not give details on the sample sizes for the relevant surveys. However, available methodology documents report that the Freshlogic data uses approximately 1,200 participants per month.[90]

Non-response error occurs in this case when consumers who have signed up to participate fail to follow through on the scheme. In the present context this would only include overall survey non-response in which the consumer completely stops participation. (Failure to report some of the purchases would properly be regarded as measurement error in this context.) This form of non-response is similar in its effects to the sampling frame or sampling error caused by the self-selection of consumers.

Measurement error occurs when the participating consumer gives incorrect information to the surveyor regarding their purchases. This would include both the failure to report relevant purchases or any error in the information submitted. For the Freshlogic survey the information is obtained from submission of dockets by consumers so that the only source of measurement error is the failure to submit a relevant docket. In the case of the Nielsen survey the information is obtained from consumer scans of the items and input of prices. Measurement error would include failure to scan a relevant item (or accidentally scanning it more than once) or any error in inputting the prices into the scanner. The degree of measurement error would depend on the behaviour of the participant and the present consultant is not in a position to assess this.

Processing error would include cases of data entry errors, coding errors or editing errors by the surveyor. This is usually a minor source of error in surveys and as with the supply-side surveys the size of this error would depend on the effectiveness of quality control processes adopted by the surveyor and the competence of its data entry and analysis personnel. This is likely to be a small source of error.

Overall error in the surveys is a combination of these sources of error. Fortunately there is some published analysis specifically studying the level of error for the Nielsen surveys. The Nielsen data from its Homescan program was subject to an analysis by academic researchers on behalf of the US Department of Agriculture.[91] This analysis compared purchasing records from the Nielsen Homescan program with data from a large grocery retailer to measure the accuracy of data inputs by program participants. According to the report, "[t]his analysis suggests that

[90] http://freshlogic.com.au/content/methodology
[91] Einav, L., Leibtag, E. and Nevo, A. (2008) *On the accuracy of Nielsen Homescan data*. USDA Economic Research Service, Economic Research Report No. 69.

the Homescan data contain recording errors in several dimensions, but that the overall accuracy of self-reported data by Homescan panelists seems to be in line with many other surveys of this type. ... We compared the recording errors we find here to errors in ... commonly used economic data sets and find that errors in Homescan are of the same order of magnitude as errors in earnings and employment-status data."[92]

There is presently no published research information on the accuracy of the Freshlogic data, however its similarity to the system used by AC Nielsen might suggest that it would have similar error characteristics. (Of course, this is not to say that both companies provide the exact same level of accuracy — just that they use the same general kind of statistical method.)

Table 6.2. Summary of sources of error in demand-side data

Frame error/ Non-response error	• Sampling frame is obtained by self-selection of consumers to participate. Only weak incentives for participation. • Major disparity between the population of consumers as a whole and the type of consumer participating in the survey. Possibly also have some consumers stop responding due to the amount of work required to participate. • Surveyors attempt to adjust for this using covariate information. This is still likely to be a large source of error.
Sampling error	• Neilsen and Freshlogic reports do not include reported standard error measures or sample sizes. This means that sampling error cannot be calculated. • The level of sampling error depends on the number of consumers participating in each survey. Smaller samples mean higher potential for error.
Measurement error	• Published research suggests that Homescan data contains recording errors. There is no corresponding research for the Freshlogic data. • Homescan errors are of the same order of magnitude as measurement errors in earnings and employment status data in other economic research.
Processing error	• Degree of error depends on the quality control processes of the agencies and the competence of staff doing data entry and analysis. • This is likely to be a very small source of error in the surveys.

[92] Ibid, p. 26.

Appendix A – Data from survey of vegetable growers

This Appendix sets out descriptive statistics for the data from the survey of vegetable growers. The full data set (with unit level responses) is in spreadsheet form and has been supplied to AUSVEG. A copy of the printed version of the survey is attached in Annexure A. This sets out all the questions for the survey. The questions in the online version of the survey were the same as in the printed version though the introductory description was slightly longer for the online version of the survey. The online survey also included some mandatory questions.

Qualifications for survey: This was assessed by Questions 1-2 of the survey. These questions asked the respondent to identify the capacity in which they took the survey and the nature of the vegetable growing business they work for. The responses to the two questions are set out in the contingency table below.

Table A.1. Data for Questions 1-2

Q1: Which of the following best describes the capacity in which you are taking this survey?
Q2: Which of the following best describes the vegetable growing business you work for?

(Data are for all respondents. Ineligible respondents are highlighted in red)

Response to Question 1 \ Response to Question 2	In Australia	No response	Not in Australia
Vegetable grower	87	2	0
Representative/employee of vegetable business	30	1	0
Neither	0	17	0
TOTAL RESPONDENTS	**137**		
QUALIFIED RESPONDENTS	**120**		

Awareness/use of AUSVEG statistical information: This was assessed by Questions 3-4 of the survey. These questions asked the respondent whether they were aware of AUSVEG statistical information and, if so, what information they had accessed. The responses to the two questions are set out in the tables below.

Table A.2. Data for Question 3

Q3: AUSVEG provide 'Industry Statistics' for the vegetable industry on their website.
Prior to reading this question, were you aware of this?

Response	Count
Yes	75
No	36
TOTAL RESPONDENTS	**111**

Table A.3. Data for Question 4

Q4: What kinds of 'Industrial Statistics' have you accessed from the AUSVEG website? (Select all that apply)

Category	Accessed
Vegetable production	48
Vegetable use	33
Vegetable growers	28
Farm characteristics	15
Vegetable growing conditions	13
Vegetable yields	28
Vegetable prices	31
Trade	23
Financial performance	20
Statistics for a specific vegetable	33

Number of Categories accessed	Count
1	9
2	7
3	16
4	12
5	9
6	2
7	3
8	2
9	1
10	5
TOTAL	**66**

Since the response variable in this question is Boolean, the pairwise correlations between the responses in each of these categories can be measured using Pearson's coefficient. The matrix of correlation coefficients is set out in the table below. (Note that the correlation matrix is symmetrical around the main diagonal – the upper values are omitted for ease of reference.)

Table A.4. Pairwise correlations for Question 4

(Measured by Pearson's coefficient)

	Vegetable production	Vegetable use	Vegetable growers	Farm characteristics	Vegetable growing conditions	Vegetable yields	Vegetable prices	Trade	Financial performance	Statistics for a specific vegetable
Vegetable production	1.00									
Vegetable use	0.73	1.00								
Vegetable growers	0.63	0.56	1.00							
Farm characteristics	0.45	0.49	0.63	1.00						
Vegetable growing conditions	0.40	0.43	0.47	0.50	1.00					
Vegetable yields	0.60	0.49	0.61	0.49	0.52	1.00				
Vegetable prices	0.62	0.63	0.48	0.42	0.45	0.54	1.00			
Trade	0.51	0.51	0.47	0.43	0.52	0.55	0.52	1.00		
Financial performance	0.45	0.47	0.46	0.52	0.43	0.51	0.56	0.51	1.00	
Statistics for a specific vegetable	0.65	0.55	0.63	0.40	0.39	0.53	0.63	0.54	0.47	1.00

Types of data that are useful to your business: This was assessed by Questions 5-8 of the survey. These questions asked the respondent to give an ordinal ranking for the usefulness of different categories of data and also specify any other types of data that would be useful. The responses to Questions 5-6 are set out in the contingency table below. This table gives raw counts for each response as well as cumulative counts consistent with the ordinal measure. This allows assessment of ordinal-dominance among different categories.

Table A.5. Data for Questions 5-6

Q5-6: For each of the following categories of information, how useful is it to your business to obtain statistical data on this subject?*

Category	Very useful	Useful	Somewhat useful	Not useful **
Vegetable production	22 (22)	45 (67)	24 (91)	7 (98)
Vegetable use	29 (29)	40 (69)	21 (90)	8 (98)
Vegetable growers	15 (15)	41 (56)	30 (86)	12 (98)
Farm characteristics	16 (16)	29 (45)	35 (80)	18 (98)
Vegetable growing conditions	14 (14)	34 (48)	32 (80)	18 (98)
Vegetable yields	28 (28)	44 (72)	16 (88)	10 (98)
Vegetable prices	42 (42)	32 (74)	18 (92)	6 (98)
Trade	28 (28)	27 (55)	32 (87)	11 (98)
Financial performance	24 (24)	33 (57)	29 (86)	12 (98)
Consumption of vegetables	33 (33)	37 (70)	21 (91)	7 (98)
Market research about consumers	32 (32)	42 (74)	15 (89)	9 (98)
Data for growers outside Australia	10 (10)	33 (43)	32 (75)	23 (98)
Climate and weather data	30 (30)	40 (70)	18 (88)	10 (98)
TOTAL RESPONDENTS	**98**			

Non-parenthetic values in the table are the counts for the relevant response. Parenthetic values are cumulative values from left to right. Each row gives a cumulative total equal to the total respondents.

* This was split into two separate questions in the survey, to demarcate categories of data published by AUSVEG and categories not published by AUSVEG. The questions been combined in the presentation of the data for ease of reference. Exact wording for both questions and answers is shown in Annexure A.

** One response in the fax survey marked two categories as useful and left the other categories blank (these are marked with **). This was taken to mean that other categories were not useful. (This can be regarded as an imputation of missing values based on an interpretation of their likely meaning.)

Question 7 gave respondents the opportunity to set out other kinds of useful data in an open-answer format. This open-answer format allowed respondents to give a written response setting out any types of data that would be useful to their business. The responses to this question are set out in the table below. For ease of reference they have been grouped into categories.

Table A.6. Data for Question 7 Q7: Are there any other types of statistical data that would be useful to your business?
Production and Prices
Accuracy of crop yields for benchmarking
Generally potato production, price, and Hectares grown each year
Price difference from farm to consumers via Coles Woolworths, etc. Shoppers need to be aware that farmers do not get what they pay in supermarket. Show data of what farmers get + what they are sold for.
Wholesale prices for seasonal vegetables. You'll say "Subscribe to Flemington markets" or "Buy the Land", however this is an exorbitant cost to the smaller vegetable grower.
When I made an enquiry a year ago re lower prices for vegetables at the marketplace I asked the question "Did it correspond to greater throughput?" and was told such data was not available. I haven't gone to the website to look at your data but will do so now and see if I can find what I'd like to know. Question 45 seems to indicate such data is available. Perhaps I asked the wrong person!
I want to know how much money is the merchant selling my product to retailers for.
Data Accuracy
accurate market prices, not the totally inaccurate stuff being collected now
DATA QUALITY Not Qty. If not practicable to supply good figures then save us the trouble
Biosecurity
AQIS, DAFF and Bio-security risks of pests and diseases for vegetable crops, and how they establish their risk assessments. Data on the costs to industry and individual farmers of breeches of quarantine and bio-security.
Markets and Consumption
Consumption not just by value but by kg per person What is on the consumers plate The amount of vegetables consumed per person eating out of home (at cafe / restaurants / food service) Changes in consumer consumption behaviour
Consumption, Nielsen Homescan, Customer and Household Information, Market Size (Fresh, processed, frozen)
Real time information on volumes on market
Gaps in the market. Eg. High demand, low supply
Retailer trends.
Carbon dioxide usage
Carbon usage and input
The amount of carbon miles travelled, with the chains buying off farm and not at the local market. The amount of carbon miles travelled against produced that could be purchased at a local location Example. Lettuce that is purchased in Sydney or Melbourne, sold in Brisbane or Toowoomba, when lettuce is grown in those areas during their growing period.
Specific vegetables or regions
to have a market report that included Rockmelons in it like all the other fruit and veg
More production data that is broken down further. Eg. Salad/Lettuce production could be broken down to, iceberg, cos(all types)& loose leaf. We know there is growth and shrinkage in some of these categories but there is no hard data to prove it.
Total consumption of vegetables in their catagories.eg Leafy, root or grown on plants.
Consumption of potatoes by variety Use of certified seed by commercial growers by variety
Region specific data, ie Climate, soil testing, produce outloaded from region.
Growers outside Australia
How many operations are owned or financed by overseas investors/operators. Information on tariffs applied to import / export produce. And what sort of agriculture subsidises we are competing with on the world stage.
The types of vegetable crops grown in similar climactic conditions word-wide and the success of these.

Question 8 asked the respondent to identify whether they were interested only in data on vegetables grown in their own business, or if there interest extended to all vegetables, including those not grown in their own business.

Table A.7. Data for Question 8 Q8: For data pertaining to specific types of vegetables (e.g., carrots, lettuce, tomatoes, etc.), which of the following best describes the type of data that is useful to your business??	
Response	**Count**
Only interested in vegetables grown in my business	31
Interested in all types of vegetables	67
TOTAL RESPONDENTS	**98**

Data characteristics that are important to your business: This was assessed by Questions 9-10 of the survey. These questions asked the respondent to give an ordinal ranking for the importance of different characteristics of data and indicate the purposes of data use in the business. The responses to Question 9 are set out in the contingency table below.

Table A.8. Data for Question 9 Q9: When you are using statistical data for your business, how important are each of the following characteristics?				
Category	**Very important**	**Important**	**Somewhat important**	**Not important**
Accurate	59 (59)	31 (90)	6 (96)	1 (97)
Updated regularly and promptly	41 (41)	47 (88)	8 (96)	1 (97)
Accompanied by graphs	11 (11)	30 (41)	44 (85)	12(97)
Specified the data source	29 (29)	44 (73)	20 (93)	4 (97)
Includes historical comparison	20 (20)	59 (79)	14 (93)	4 (97)
Discusses methodology	30 (30)	33 (63)	29 (92)	5 (97)
TOTAL RESPONDENTS	**97**			

Non-parenthetic values in the table are the counts for the relevant response. Parenthetic values are cumulative values from left to right. Each row gives a cumulative total equal to the total respondents.

The response variables in Questions 5, 6 and 9 are ordinal categorical rankings, which means that the pairwise rank-correlations between the responses in each of these categories can be measured using Kendall's Tau-B coefficient.[93] This measure is based on counts of concordance and discordant pairs of data points as well as tied pairs. The measure makes use of the ordinal ranking of the answer categories but does not make use of any coding value used to represent this category.[94] The matrix of rank-correlation coefficients for all of these questions is set out in the table below. (Note that the correlation matrix is symmetrical around its main diagonal – the upper values are omitted for ease of reference.)

[93] Kendall, M. (1938) A New Measure of Rank Correlation. *Biometrika* **30(1–2)**, pp. 81–89; see also Fredricks, G.A. and Nelsen, R.B. (2007) On the relationship between Spearman's rho and Kendall's tau for pairs of continuous random variables. *Journal of Statistical Planning and Inference* **137**, pp. 2143-2150.
[94] Nelsen, R.B. (1992) On measures of association as measures of positive dependence. *Statistics and Probability Letters* **14**, pp. 269–274.

Table A.9. Pairwise rank-correlations for Questions 5-6 and 9

(Measured by Kendall's Tau-B coefficient)

	Accurate	Updated regularly and promptly	Accompanied by graphs	Specified the data source	Includes historical comparison	Discusses methodology	Vegetable production	Vegetable use	Vegetable growers	Farm characteristics	Vegetable growing conditions	Vegetable yields	Vegetable prices	Trade	Financial performance	Consumption of vegetables	Market research consumers	Data for growers outside Aust	Climate and weather data
Accurate	1.00																		
Updated regularly and promptly	0.58	1.00																	
Accompanied by graphs	0.16	0.21	1.00																
Specified the data source	0.22	0.27	0.22	1.00															
Includes historical comparison	0.17	0.32	0.44	0.31	1.00														
Discusses methodology	0.22	0.21	0.27	0.45	0.36	1.00													
Vegetable production	0.14	0.07	0.23	0.14	0.24	0.15	1.00												
Vegetable use	0.16	0.11	0.30	0.19	0.32	0.29	0.65	1.00											
Vegetable growers	0.16	0.09	0.37	0.19	0.25	0.33	0.61	0.47	1.00										
Farm characteristics	0.17	0.02	0.33	0.24	0.20	0.29	0.44	0.41	0.67	1.00									
Vegetable growing conditions	0.06	0.08	0.14	0.18	0.12	0.19	0.43	0.43	0.45	0.58	1.00								
Vegetable yields	0.15	0.13	0.19	0.12	0.18	0.21	0.63	0.51	0.58	0.51	0.50	1.00							
Vegetable prices	0.30	0.22	0.23	0.14	0.17	0.11	0.54	0.53	0.50	0.38	0.32	0.54	1.00						
Trade	0.29	0.20	0.31	0.23	0.25	0.26	0.38	0.56	0.44	0.42	0.33	0.46	0.42	1.00					
Financial performance	0.16	0.15	0.18	0.13	0.20	0.29	0.43	0.52	0.51	0.40	0.36	0.57	0.50	0.55	1.00				
Consumption of vegetables	0.11	0.10	0.42	0.25	0.32	0.20	0.69	0.62	0.51	0.38	0.36	0.48	0.48	0.45	0.39	1.00			
Market research consumers	0.13	0.11	0.27	0.18	0.22	0.17	0.60	0.61	0.36	0.35	0.41	0.44	0.46	0.41	0.31	0.65	1.00		
Data for growers outside Aust	0.09	0.14	0.24	0.22	0.24	0.16	0.42	0.42	0.35	0.35	0.39	0.35	0.29	0.39	0.43	0.41	0.47	1.00	
Climate and weather data	0.00	0.13	0.24	0.15	0.11	0.19	0.27	0.25	0.29	0.18	0.39	0.31	0.26	0.14	0.20	0.28	0.24	0.21	1.00

Question 10 asked respondents to identify the purposes for which they use statistical data in their business. The response to this question is set out in the tables below.

Table A.10. Data for Question 10

Q10: What do you use statistical data for in your business? (Select all that apply)

Category	Use data for this
Short-term planning	57
Long-term planning	70
Marketing to consumers	50
Lobbying Government	19
Business comparison	47
General interest/education	65

Number of Categories used	Count
1	10
2	21
3	25
4	22
5	15
6	3
TOTAL	**96**

Since the response variable in this question is Boolean, the pairwise correlations between the responses in each of these categories can be measured using Pearson's coefficient. The matrix of correlation coefficients is set out in the table below. This also includes the correlation of each outcome with the count of other business-related uses excluding general interest/education. (Note that the correlation matrix is symmetrical around the main diagonal – the upper values are omitted for ease of reference.)

Table A.11. Pairwise correlations for Question 10

(Measured by Pearson's coefficient)

	Count of other business-related uses (excl. general interest)	Short-term decisions	Long-term decisions	Marketing	Lobbying Govt.	Business comparison	General interest/education
Short-term decisions	0.28	1.00					
Long-term decisions	0.51	0.26	1.00				
Marketing	0.40	0.21	0.41	1.00			
Lobbying Govt.	0.19	-0.05	0.23	0.14	1.00		
Business comparison	0.43	0.26	0.37	0.26	0.21	1.00	
General interest/education	0.43	0.31	0.27	0.34	0.08	0.29	1.00

Characteristics of your business: This was assessed by Questions 11-14 of the survey. In Questions 11-12 respondents were asked how many vegetables the business produces, the EVAO of the business in the last financial year. These were both measured on a categorical ordinal scale. The responses to these questions are set out in the tables below.

Table A.12. Data for Question 11

Q11: How many different types of vegetables does your business produce?

Number of vegetables produced	Count
1	22 (22)
2	14 (36)
3	14 (50)
4	8 (58)
5	7 (65)
6	9 (74)
7	1 (75)
8	5 (80)
9	1 (81)
10	5 (86)
11-15	2 (88)
16-20	1 (89)
21 or more	5 (94)
TOTAL RESPONDENTS	**94**

Non-parenthetic values in the table are the counts for the relevant vegetable numbers. Parenthetic values are cumulative values going up to the maximum vegetable numbers at the upper bound of that category.

Table A.13. Data for Question 12

Q12: What was the estimated annual value of the agricultural operations for your business in the last financial year?

EVAO	Count		EVAO	Count
Up to $22,500	2 (2)		$450,001 - $500,000	4 (27)
$22,501 - $50,000	6 (8)		$500,001 - $600,000	1 (28)
$50,001 - $100,000	3 (11)		$600,001 - $700,000	0 (28)
$100,001 - $150,000	3 (14)		$700,001 - $800,000	2 (30)
$150,001 - $200,000	0 (14)		$800,001 - $900,000	1 (31)
$200,001 - $250,000	3 (17)		$900,001 - $1,000,000	4 (35)
$250,001 - $300,000	0 (17)		$1,000,001 - $1,500,000	7 (42)
$300,001 - $350,000	1 (18)		$1,500,001 - $2,000,000	4 (46)
$350,001 - $400,000	4 (22)		More than $2,000,000	31 (77)
$400,001 - $450,000	1 (23)		Unable to estimate	19
TOTAL RESPONDENTS				**96**

Non-parenthetic values in the table are the counts for the relevant EVAO category. Parenthetic values are cumulative values going up to the maximum EVAO at the upper bound of that category.

The pairwise rank-correlation between these items above (measured by the Tau-B coefficient) was 0.18. In order to preserve a legitimate rank-ordering for this calculation, we removed the respondents who were unable to estimate their EVAO, leaving 77 valid responses. The EVAO measure was weakly correlated with responses from Questions 5, 6 and 9. The pairwise rank-correlations for these items (measured by the Tau-B coefficient) are set out in the table below.

Table A.14. Pairwise rank-correlation with EVAO

(Measured by Kendall's Tau-B coefficient)

Response	Rank correlation
Accurate	0.10
Updated regularly and promptly	- 0.03
Accompanied by graphs	0.01
Specified the data source	- 0.02
Includes historical comparison	0.30
Discusses methodology	0.06
Vegetable production	0.08
Vegetable use	0.07
Vegetable growers	0.05
Farm characteristics	0.06
Vegetable growing conditions	- 0.08
Vegetable yields	0.04
Vegetable prices	- 0.06
Trade	0.07
Financial performance	0.05
Consumption of vegetables	0.13
Market research consumers	0.10
Data for growers outside Australia	0.09
Climate and weather data	- 0.20

Questions 13-14 asked respondents about the organisational structure of the business, and whether or not the business has used paid statistical consultancy in the last financial year. The responses to these questions are set out in the tables below.

Table A.15. Data for Question 13

Q13: What is the structure of your vegetable growing business?

Business structure	Count
Sole trader	14
Small partnership	29
Large partnership	3
Small company	25
Large company	5
Multiple related companies	13
Other	7
TOTAL RESPONDENTS	**96**

Table A.16. Data for Question 14 Q14: In the last financial year, has your business paid any money to obtain data or statistical services from a consultant, survey company or other provider?	
Response	**Count**
Yes	24
No	72
TOTAL RESPONDENTS	**96**

Additional information: Respondents were given the opportunity to give personal contact information in order to be eligible for a prize draw for the survey. (The prize was a Samsung Galaxy S3 mobile phone.) This contact information included the State/Territory of the resident. This information is set out in the table below.

Table A.17. Data on State/Territory	
Response	**Count**
NSW	2
VIC	25
QLD	21
WA	4
SA	10
TAS	7
NT	0
ACT	1
TOTAL RESPONDENTS	**70**

Full raw data for the survey (with identifying information for growers omitted) was supplied to AUSVEG as part of the present project. This raw data allows more detailed results concerning the relationship between different responses. In particular, it is possible to use the raw data to obtain contingency tables for combinations of the various questions or to look at individual responses to see how answers to different questions were related. We have summarised this information here by reporting pairwise rank-correlations for certain pairs of questions.

Appendix B – Scaled responses from survey of vegetable growers

This Appendix sets out descriptive statistics for the data from the survey of vegetable growers after scaling is applied to the data based on the EVAO classification in ABS data. Weightings for scaling via EVAO categories was done using the EVAO breakdown in the ABSBR set out in Table C.3 in Appendix C. Weights were calculated by to ensuring that total weight in each category was proportional to the estimated counts in the ABS data, with the total weighting being equal to the total number of respondents who reported their EVAO. The categories in the ABSBR data are courser than the categories in the survey but the borders of these categories line up (the survey was designed to ensure this) allowing categories in the survey data to be merged to be consistent with the categories in the ABSBR

The resulting weights obtained from this calculation process and used for scaling are set out in Table B.1 below. Note that the total scaling mass for all responses still adds up to 120, which is the number of respondents in the survey; the average weighting-per-response is still one. (All figures have been rounded to one decimal place.)

Table B.1. Counts and weightings for EVAO categories

(Weightings are based on scaling to EVAO values in Table C.3 in Appendix C.)

EVAO	Count	Weight	EVAO	Count	Weight
Up to $22,500	2	8.56	$450,001 - $500,000	4	0.44
$22,501 - $50,000	6	2.20	$500,001 - $600,000	1	1.51
$50,001 - $100,000	3	3.60	$600,001 - $700,000	0	N/A
$100,001 - $150,000	3	2.46	$700,001 - $800,000	2	0.76
$150,001 - $200,000	0	N/A	$800,001 - $900,000	1	1.51
$200,001 - $250,000	3	1.05	$900,001 - $1,000,000	4	0.38
$250,001 - $300,000	0	N/A	$1,000,001 - $1,500,000	7	0.40
$300,001 - $350,000	1	3.15	$1,500,001 - $2,000,000	4	0.71
$350,001 - $400,000	4	0.44	More than $2,000,000	31	0.17
$400,001 - $450,000	1	1.74	No answer/No estimate *	43	1.00

* Respondents who did not answer the EVAO question were taken to be in the same weighting category as those who answered that they were unable to estimate. These respondents were all given a weighting of one so that their contribution to the output was not scaled up or down.

The above weightings were applied to recalculate data outcomes for a range of questions in the survey of growers. This led to some changes in the counts and percentages in the response categories. Due to the scaling some measures that were previously integer counts are now able to take on non-integer values.

The rescaled data for Questions 4 and 10 using the above weightings are set out in Tables B.2-3 below. These tables refer to scaled counts of responses. Though the raw count values must be integers, the scaling means that we obtain non-integer values. (All figures have been rounded to one decimal place.)

Table B.2. Scaled data for Question 4

(Rescaled using EVAO weightings *)

Category	Accessed (scaled)
Vegetable production	48.1
Vegetable use	24.4
Vegetable growers	27.3
Farm characteristics	11.4
Vegetable growing conditions	9.3
Vegetable yields	23.5
Vegetable prices	27.9
Trade	14.5
Financial performance	17.4
Statistics for a specific vegetable	32.3

Number of Categories accessed	Count (scaled)
1	5.7
2	12.3
3	15.3
4	14.5
5	7.6
6	1.7
7	1.6
8	2.4
9	0.2
10	2.1
TOTAL	**63.5**

Table B.3. Scaled data for Question 10

(Rescaled using EVAO weightings *)

Category	Use data for this (scaled)
Short-term planning	63.3
Long-term planning	38.4
Marketing to consumers	10.1
Lobbying Government	51.1
Business comparison	53.8
General interest/education	59.8

Number of Categories used	Count (scaled)
1	21.5
2	24.5
3	14.7
4	20.6
5	14.0
6	1.6
TOTAL	**96.8**

All figures have been rounded to one decimal place. This means that rounding discrepancies may occur between the individual values and the total.

The rescaled data for Questions 5, 6 and 9 using the above weightings are set out in Tables B.4-5 below. These tables refer to scaled counts of responses. Though the actual raw count values are all integer values, the scaling means that these are no longer integer values. (All figured have been rounded to one decimal place.)

Table B.4. Scaled data for Questions 5-6

(Rescaled using EVAO weightings *)

Category	Very useful	Useful	Somewhat useful	Not useful
Vegetable production	14.6 (14.6)	43.8 (58.4)	27.2 (85.6)	12.4 (98.0)
Vegetable use	19.9 (19.9)	37.2 (57.1)	27.2 (84.3)	13.7 (98.0)
Vegetable growers	12.2 (12.2)	33.6 (45.8)	35.5 (81.3)	16.7 (98.0)
Farm characteristics	11.2 (11.2)	20.3 (31.6)	45.2 (76.8)	21.2 (98.0)
Vegetable growing conditions	12.3 (12.3)	34.9 (47.2)	29.6 (76.8)	21.2 (98.0)
Vegetable yields	21.2 (21.2)	43.7 (64.9)	19.5 (84.3)	13.7 (98.0)
Vegetable prices	37.9 (37.9)	27.8 (65.8)	21.2 (86.9)	11.1 (98.0)
Trade	24.0 (24.0)	21.6 (45.7)	36.5 (82.1)	15.9 (98.0)
Financial performance	19.8 (19.8)	27.8 (47.6)	34.3 (81.9)	16.1 (98.0)
Consumption of vegetables	23.2 (23.2)	42.6 (65.8)	17.8 (83.6)	14.4 (98.0)
Market research about consumers	22.9 (22.9)	35.1 (58.0)	24.2 (82.2)	15.8 (98.0)
Data for growers outside Australia	5.8 (5.8)	27.7 (33.4)	38.7 (72.2)	25.8 (98.0)
Climate and weather data	31.7 (31.7)	40.2 (71.9)	10.6 (82.5)	15.5 (98.0)
TOTAL RESPONDENTS	**98**			

Table B.5. Scaled data for Question 9

(Rescaled using EVAO weightings *)

Category	Very important	Important	Somewhat important	Not important
Accurate	53.7 (53.7)	35.3 (89.0)	7.8 (96.8)	0.2 (97.0)
Updated regularly and promptly	44.5 (44.5)	44.8 (89.3)	7.5 (96.8)	0.2 (97.0)
Accompanied by graphs	9.4 (9.4)	29.2 (38.6)	39.5 (78.1)	18.9 (97.0)
Specified the data source	33.8 (33.8)	47.7 (81.4)	13.8 (95.3)	1.7 (97.0)
Includes historical comparison	10.6 (10.6)	53.1 (63.6)	22.6 (86.3)	10.7 (97.0)
Discusses methodology	28.1 (28.1)	29.0 (57.1)	37.7 (94.8)	2.2 (97.0)
TOTAL RESPONDENTS	**97**			

Non-parenthetic values in these tables are the scaled counts for the relevant response. Parenthetic values are cumulative scaled values from left to right. Each row gives a cumulative total equal to the scaled total respondents, which is equal to the actual number of respondents.

* All figures have been rounded to one decimal place. This means that rounding discrepancies may occur between the individual values and the total.

Appendix C – Counts of business units from ABSBR

The following tables set out counts of business units in the ABSBR. These are the data values used to generate the charts in the main body of the report. Each table specifies the data source of the data values by document and page number.

Table C.1. Counts of growers on ABSBR			
Year	**Count**	**Cat.**	**Data Source**
1997-98	4772	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 1997-98, p. 8
1998-99	5109	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 1998-99, p. 10
1999-00	5313	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 1999-00, p. 11
2000-01	5065	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 2000-01, p. 5
2001-02	4805	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 2001-02, p. 13
2002-03	4391	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 2002-03, p. 13
2003-04	4297	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 2003-04, p. 13
2004-05	4090	0113 *	ABS • *Agricultural Commodities* • 7121.0 • 2004-05, p. 13
2005-06	5226	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2005-06, p. 11
2006-07	5062	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2006-07, p. 11
2007-08	4549	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2007-08, p. 11 **
2008-09	4489	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2008-09, p. 11
2009-10	4355	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2008-09, p. 12 **
2010-11	4186	0121-3	ABS • *Agricultural Commodities* • 7121.0 • 2008-09, p. 13

* Count data in reports from 1997-2005 used the ANZSIC 1993 classification which used a single category for Vegetable Growers (0113). Other categories were also different.

** Count data for categories 0122 and 0123 are aggregated in these reports.

Table C.2. Counts of growers, businesses and residents on ABSBR by State			
State	**Grow**	**Bus**	**Res**
NSW	1071	706,777	7,211,468
Vic	713	544,075	5,534,526
Qld	1086	430,548	4,474,098
SA	492	148,277	1,638,232
WA	456	222,251	2,352,215
Tas	324	38,767	511,195
NT	42	14,525	231,331
ACT	2	256,32	367,752

Data	Data Source
Growers *	ABS • *Agricultural Commodities* • 7121.0 • 2010-11, p. 13
Businesses	ABS • *Count of Businesses* • 8165.0 • 2007-11, p. 15
Residents	ABS • *Australian Demographic Statistics* • 3101.0 • Mar 2012, p. 29

* Count data for categories 0121-0123 are aggregated to obtain totals for vegetable growers.

Table C.3. Counts of growers on ABSBR by EVAO			
EVAO ($000s)	**Count**	**Length**	**Scaled ***
0 - 22.5	834	22.5	370.67
22.5 – 50	643	27.5	233.82
50 – 100	526	50	105.20
100 - 150	359	50	71.80
150 – 200	207	50	41.40
200 – 350	461	150	30.73
350 – 500	255	150	15.60
500 – 1000	368	500	7.36
1000 – 2000	276	1000	2.76
> 2000	257	** 1500	1.71
Data Source			
ABS • *Agricultural Commodities* • 7121.0 • 2010-11, p. 14			

* Scaled interval length is a frequency density calculation scaled to show number of growers per $10,000 interval length. The calculation is Scaled count $= (10/\text{Length}) \times \text{Count}$.

** Since no data on maximum EVAO was reported it was not possible to find the interval length for this category. This has been set arbitrarily to an interval length of 1500, consistent with the increasing pattern of previous intervals. This choice of length would affect the scaled count for the last category.

The following table sets out sampling information from the ABARES surveys into the vegetable industry. These surveys use the ABSBR as a sampling frame but impose an EVAO threshold on the businesses in the frame. The table sets out counts of businesses in the sampling frame and sample in each year as well as information on the EVAO threshold and methodology.

Table C.4. Sampling for ABARES surveys				
Year	**Frame**	**Samp**	**Threshold**	**Sampling/Estimation Methodology**
2009-10	2955	280	EVAO ≥ $40,000	Stratified sampling with benchmarks
2008-09	3259	278	EVAO ≥ $40,000	Stratified sampling with benchmarks
2007-08	3781	288	EVAO ≥ $40,000	Stratified sampling with benchmarks
2006-07	4222	287	EVAO ≥ $40,000	Stratified sampling *
2005-06	2822	266	EVAO ≥ $40,000	Stratified sampling *

* The first two surveys did not use the benchmarking method used in later surveys. However, the data from these earlier surveys was retrospectively reweighted using the later benchmark method to obtain comparable data. (This recalibrated data is not in the original reports but is available from ABARES.)

Appendix D – List of ABS data publications and data sets

The following is a list of compiled data sets and other information from relevant catalogues of data on the ABS website. All of these data sets are publicly available unless they are specified as having ceased. The table sets out the name of each publication and its catalogue number as well as specifying the type of publication, the latest year of issue and the number of issues available on the ABS website. (In cases where a parenthetic year of issue appears this refers to the latest year in which information relevant to vegetable growers is contained in the publication.) Data sets are highlighted in yellow.

Table D.1. Documents available from the ABS

Data Set/Document	Catalogue number	Type	Latest	Issues
CATALOGUE 71 (Agricultural Statistics – general)				
Ag Mag – The Agricultural Newsletter	7101.0	Newsletter	2012	12
Characteristics of Australian Farms	7102.0	Data Set	1993	2
Agricultural Census: ABS Views on Content and Procedures	7103.0	Information Paper	2005-06	1
Agricultural Census: ABS Views on Content and Procedures	7.103.0.80.002	Information Paper	2010-11	1
Agriculture in Focus: Farming Families, Australia	7.104.0.55.001	Data Set	2006	1
Agriculture in Focus: Farmers' Perception of Change in Climate	7.104.0.55.002	Data Set	2006-07	1
ABS Agricultural Statistics Collection Strategy – 2008-09 and beyond	7105.0	Methodology paper	2009-10	3
Discussion Paper: Environment and Agriculture Survey Program Review	7105.0.55.001	Discussion Paper	2011-12	1
Australian Farming in Brief	7106.0	Data Set (summary)	2012	16
Information Paper: AgStats Australia	7107.0	Information Paper	1992-93	1
Home Production of Selected Foodstuffs, Australia	7110.0	Data Set	1992	1
Principal Agricultural Commodities, Australia*	7111.0	Data Set	2010-11	17
Agricultural Survey: Farm Business Operations and Management, Australia	7111.0.55.001	Data Set	2001-02	1
Agricultural Survey: Apples and Pears, Australia*	7111.0.55.002	Data Set	2004-05	4
Principal Commodities: Australia	7111.0.55.003	Data Set	2001-02	1
Principal Commodities: New South Wales *	7111.1	Data Set	1996-97	3
Principal Commodities: Victoria *	7111.2	Data Set	1996-97	4
Principal Commodities: Queensland *	7111.3	Data Set	1996-97	3
Principal Commodities: South Australia *	7111.4	Data Set	1996-97	4
Principal Commodities: Western Australia *	7111.5	Data Set	1996-97	5
Principal Commodities: Tasmania *	7111.6	Data Set	1996-97	4

Selected Commodities, Australia	7112.0	Data Set	2005-06	3
Agriculture: Australia	7113.0	Data Set	1999-00	7
Agriculture: New South Wales	7113.1	Data Set	1996-97	6
Agriculture: Victoria	7113.2	Data Set	1996-97	3
Agriculture: Queensland	7113.3	Data Set	1996-97	4
Agriculture: South Australia	7113.4	Data Set	1996-97	4
Agriculture: Western Australia	7113.5	Data Set	1996-97	5
Agriculture: Tasmania	7113.6	Data Set	1994	1
Agriculture and Fishing: Northern Territory	7113.7	Data Set	1996-97	4
Agriculture: Tasmania	7114.6	Data Set	1996-97	5
AgStats on CD-ROM	7115.0	Ceased - no longer available		
AgStats on Magnetic Tape	7116.0	Ceased - no longer available		
AgStats on Floppy Disk	7117.0	Ceased - no longer available		
AgStats on GSP	7117.0.30.001	Ceased - no longer available		
AgStats on Microfiche	7118.0	Ceased - no longer available		
AgStats Manual	7119.0	Manual	1995-96	1
Agricultural Statistics, Selected Small Area Data: New South Wales	7120.1	Data Set	1993-94	2
Agricultural Statistics, Selected Small Area Data: Victoria	7120.2	Data Set	1993-94	2
Agricultural Statistics, Selected Small Area Data: Queensland	7120.3	Data Set	1992-93	1
Agricultural Statistics, Selected Small Area Data: South Australia	7120.4	Data Set	1992-93	1
Agricultural Statistics, Selected Small Area Data: Western Australia	7120.5	Data Set	1992-93	1
Agricultural Commodities: Australia	7121.0	Data Set	2010-11	14
Agricultural State Profile: New South Wales	7123.1.55.001	Data Set	2006-07	3
Agricultural State Profile: Victoria	7123.2.55.001	Data Set	2006-07	5
Agricultural State Profile: Queensland	7123.3.55.001	Data Set	2006-07	5
Agricultural State Profile: South Australia	7123.4.55.001	Data Set	2006-07	5
Agricultural State Profile: Western Australia	7123.5.55.001	Data Set	2006-07	3
Agricultural State Profile: Tasmania	7123.6.55.001	Data Set	2006-07	3
Agricultural State Profile: Northern Territory	7123.7.55.001	Data Set	2006-07	3
Historical Selected Agriculture Commodities by State (1861 to present)	7124.0	Data Set	2009-10	5
Agricultural Commodities, Small Area Data: Australia	7125.0	Data Set	2006-07	3
Principal Agricultural Commodities, Third Estimates: Australia	7126.0	Data Set	2005-06	1
Agricultural Land and Water Ownership	7127.0	Data Set	2010	1
CATALOGUE 73 (Crops and Pastures)				
Crops and Pastures: Queensland	7321.3	Data Set	1992-93	1
Summary of Crops: Australia	7330.0	Data Set	1992-93	6
Crops, Pastures and Fruit: Victoria	7330.2	Data Set	1993-94	2
Summary of Crops: South Australia	7330.4	Data Set	1992-93	1
Summary of Crops: Western Australia	7330.5	Data Set	1992-93	1
CATALOGUE 74 (Agricultural Land Use)				
Agricultural Land Use and Selected Inputs: Victoria	7411.2	Data Set	1992-93	1
Agricultural Land Use and Selected Inputs: Queensland	7411.3	Data Set	1992-93	1

CATALOGUE 75 (Agricultural Financial Statistics and Value of Products)				
Value of Principal Agricultural Commodities Produced: Australia *	7501.0	Data Set	2010-11	19
Value of Selected Agricultural Commodities Produced: Australia *	7502.0	Data Set	2005-06	1
Value of Agricultural Commodities Produced: Australia	7503.0	Data Set	2010-11	26
Value of Agricultural Commodities Produced: Victoria	7503.2	Data Set	1993-94	2
Value of Agricultural Commodities Produced: Queensland	7503.3	Data Set	1993-94	2
Value of Agricultural Commodities Produced: South Australia	7503.4	Data Set	1992-93	1
Value of Agricultural Commodities Produced: Western Australia	7503.5	Data Set	1991-92	1
Value of Agricultural Commodities Produced: Tasmania	7503.6	Data Set	1992-93	1
Agricultural Industries Financial Statistics: Australia *	7506.0	Data Set	1999-00	9
Agricultural Industries Financial Statistics: Australia	7507.0	Data Set	1996-97	5
Item Estimates from Agricultural Finance Survey (Floppy Disk)	7507.0.15.001	Estimates	1999-00	1
Cross Classification Tables from Agricultural Finance Survey (Hardcopy)	7507.0.15.002	Explanatory Material	1994-95	1
Item Estimates from Agricultural Finance Survey (Hardcopy)	7507.0.40.001	Estimates	1994-95	1
Cross Classification Tables from Agricultural Finance Survey (Hardcopy)	7507.0.40.002	Explanatory Material	1996-97	1
OTHER MISC. CATALOGUES				
Australian Social Trends (Information on farming families)	4102.0	Data Set	2012 (2003)	30
Farm Management and Climate	4625.0	Data Set	2006-07	1
Water Use on Australian Farms	4618.0	Data Set	2010-11	10
Land Management and Farming in Australia	4627.0	Data Set	2009-10	2
Australian Industry	8155.0	Data Set	2010-11	12
* Preliminary document only				

The following is a list of compiled data sets and other information from relevant documents from agencies other than the ABS. All of these data sets are publicly available. The table sets out the name of each publication and any identifying document number (for the latest issue available) as well as specifying the type of publication, the latest year of issue and the number of issues available. Data sets and reports containing substantial amounts of data are highlighted in yellow. Data set and reports that could not be accessed by the author are highlighted in red. The author was not able to fully determine the content of these reports.

Table D.2. Documents and other resources available from other agencies				
Data Set/Document	**Doc No.**	**Type**	**Latest**	**Issues**
ABARES				
Australian Vegetable Growing Farms: An Economic Survey	11.8	Report	2010-11	5
Agricultural Commodities		Report	2012, Q3	51
International competitiveness of the Australian vegetable production sector	06.5	Report	2006	1
Weed eradication: strategies, timeframes and costs		Research paper	2004	1
APC				
Regulatory Burdens on Business: Primary Sector.	N/A	Review paper	2007	1
Trends in Australian Agriculture	N/A	Research paper	2005	1
Horticulture – Industry Commission Report	29	Report	1993	1
FAO				
FAOSTAT (online)	N/A	Database	2010	N/A
AQUASTAT (online)	N/A	Database	2012	N/A
FAO Statistical Yearbook	N/A	Data report	2012	≥ 9
World Census of Agriculture (2000)	12	Data report	2000	1
GTIS				
Global Trade Atlas (online)	N/A	Database	2012	N/A
HAL				
HORTSTATS (online)	N/A	Database	2012	N/A
AC Nielsen				
Vegetable Brand Health Reports (various)	N/A	Report	2011	≥ 13
Freshlogic				
Veginsights (monthly)	N/A	Data report	Jun 2012	≥ 75
IBISWorld				
Vegetable Growing in Australia	A0113	Report	2012	1
Vegetable Growing (Under Cover) in Australia	A0122	Report	2012	1
Vegetable Growing (Outdoors) in Australia	A0123	Report	2012	1
Fruit and Vegetable Processing in Australia	C2130	Report	2012	1
Fruit and Vegetable Wholesaling in Australia	F4715	Report	2012	1
Fruit and Vegetable Retailing in Australia	G5122	Report	2012	1
Vegetable Growing (Under Cover)	A0195	Report	2012	1
Vegetable Growing (Outdoors)	A0196	Report	2012	1
Organic Farming	X0013	Report	2012	1
Hydroponic Crop Farming	OD4155	Report	2012	1
Agribusiness	X0005	Report	2012	1
Company Research (various companies)		Reports		58
Vegetable Growing in Australia (Risk Rating)	A0113	Report	2012	1
Vegetable Growing (Under Cover) (Risk Rating)	A0122	Report	2012	1
Vegetable Growing (Outdoors) (Risk Rating)	A0123	Report	2012	1
ATO				
Taxation Statistics	N/A	Data report	2009-10	11

Appendix E – Further explanation of sampling error measures

In this Appendix we give some more information on the likely size of sampling error in the data sets under consideration. This can be done by looking at the length of statistical confidence intervals based on a given value of the relative standard error. The relative standard error and sample size are sufficient to give confidence intervals based on the underlying assumption of a normally-distributed sample mean. This assumption is satisfied as the sample mean gets larger and larger (based on a statistical theorem called the central limit theorem) and can be used as a reasonable approximation if the sample size is not too small.

The effect of the sample size on the likely amount of sampling error is set out in Figure E.1. This shows the half-lengths of confidence intervals at four different levels using a relative standard error (RSE) of 1%. These values show how far above/below the estimated value the confidence interval spans, expressed as a percentage of the estimated value. The length of the confidence interval is proportional to the RSE in each case, so that lengths for different levels of the RSE can be obtained by scaling up or down (e.g., to obtain half-lengths of the intervals for an RSE of 5% you would need to multiply the values by five).

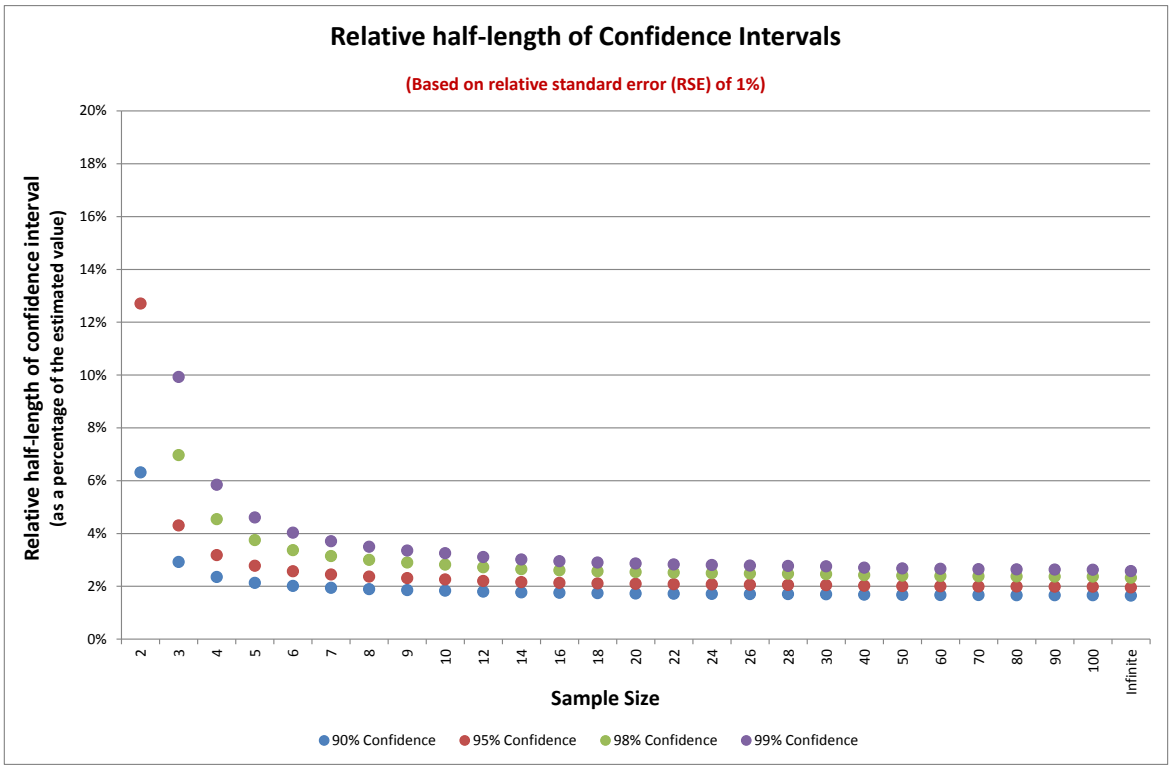

Figure E.1: Relative half-length of confidence intervals

The half-length values shown in the figure are also shown below in Table E.1. Both the figure and table show the half-length values converging towards their standard value in large samples.

Table E.1. Relative half-length of confidence intervals

(Half-length expressed as percentage of estimated value based on relative standard error (RSE) of 1% *)

Sample Size	Confidence Level			
	90%	95%	98%	99%
1	Cannot obtain confidence interval estimate			
2	± 6.31%	± 12.71%	± 31.82%	± 63.66%
3	± 2.92%	± 4.30%	± 6.96%	± 9.92%
4	± 2.35%	± 3.18%	± 4.54%	± 5.84%
5	± 2.13%	± 2.78%	± 3.75%	± 4.60%
6	± 2.02%	± 2.57%	± 3.36%	± 4.03%
7	± 1.94%	± 2.45%	± 3.14%	± 3.71%
8	± 1.89%	± 2.36%	± 3.00%	± 3.50%
9	± 1.86%	± 2.31%	± 2.90%	± 3.36%
10	± 1.83%	± 2.26%	± 2.82%	± 3.25%
12	± 1.80%	± 2.20%	± 2.72%	± 3.11%
14	± 1.77%	± 2.16%	± 2.65%	± 3.01%
16	± 1.75%	± 2.13%	± 2.60%	± 2.95%
18	± 1.74%	± 2.11%	± 2.57%	± 2.90%
20	± 1.73%	± 2.09%	± 2.54%	± 2.86%
22	± 1.72%	± 2.08%	± 2.52%	± 2.83%
24	± 1.71%	± 2.07%	± 2.50%	± 2.81%
26	± 1.71%	± 2.06%	± 2.49%	± 2.79%
28	± 1.70%	± 2.05%	± 2.47%	± 2.77%
30	± 1.70%	± 2.05%	± 2.46%	± 2.76%
40	± 1.68%	± 2.02%	± 2.43%	± 2.71%
50	± 1.68%	± 2.01%	± 2.40%	± 2.68%
60	± 1.67%	± 2.00%	± 2.39%	± 2.66%
70	± 1.67%	± 1.99%	± 2.38%	± 2.65%
80	± 1.66%	± 1.99%	± 2.37%	± 2.64%
90	± 1.66%	± 1.99%	± 2.37%	± 2.63%
100	± 1.66%	± 1.98%	± 2.36%	± 2.63%
Infinite	± 1.64%	± 1.96%	± 2.33%	± 2.58%

* Lengths are calculated based on standard confidence interval for mean estimation using a single sample. This may not be valid for small sample sizes if the underlying distribution of the quantities under study is not normally distributed. (For large sample sizes this assumption is not required.)

It is important to note that the relative standard error (RSE) is itself strongly affected by the sample size, so that most of the effect of the sample size is incorporated into this figure. This means that the above figure and table do not give the complete effect of the sample size on the interval length (they only give this for a fixed RSE). They are also calculate for inference to an infinitely large population. Inference to a finite population introduces a correction term that reduces the size of the intervals; this requires specification of the size of the population.

Appendix 3

IDEA Vegetables Australia article on ‘How serious is the Chinese threat to Australian vegetable growers?’ (published November 2012)

How serious is the Chinese threat to Australian vegetable growers?

Industry economist Ian James examines the threat posed by China to Australia's vegetable industry.

With a population over 1.3 billion, everything about China is big. It is a similar story in vegetables. China is the world's largest vegetable producer. It even dominates in vegetables not normally associated with the Chinese diet. Chinese potato production in 2010 was 74,799,084 tonnes. The total volume of the Australian vegetable industry is around 3,400,000 tonnes. The enormity of Chinese production relative to production in Australia is highlighted in Table 1 for key vegetables.

Chinese production has the potential to swamp Australian markets. However, most of China's vegetable production is consumed domestically or processed. Fresh exports as a percentage of total production are low. In Australia, with the exception of carrots (Australia's largest fresh export) it is a similar story, although the table shows higher export to production ratios compared to China. Western Australia, in particular, has a greater export tendency than other states. The low export propensity of China and Australia is not unique. Most other countries exhibit similar low export ratios for their vegetable industries. Where exports of a particular vegetable are high, it is usually because of niche marketing often associated with counter seasonal opportunities. Australian asparagus and New Zealand pumpkins into Japan are examples.

Table 1 - Production and exports of vegetables 2010

Vegetable	Production(tonnes)	Export(tonnes)	Exports as a % of production
Carrots			
Australia	267,442	73,612	27.5
China	15,899,078	506,988	3.2
Beans			
Australia	28,000	1,403	5
China	152,213,650	4,340	0.03
Cauliflowers & Broccoli			
Australia	70,900	2,935	4.1
China	8,587,842	75,611	0.9
Potatoes			
Australia	1,278,120	36,577	2.9
China	72,973,542	258,683	0.3
Cabbages			
Australia	78,800	787	1
China	32,538,878	378,986	1.16
Lettuce & Chicory			
Australia	166,100	1,116	0.67
China	13,005,000	72,268	0.55

Source of data: Food and Agriculture Organisation of the United Nations - FaoStats

There are reasons for the low export propensity of fresh vegetables. Distance that can impact on freshness is one, freight cost another, biosecurity issues a third and protective barriers, such as licensing and tariffs, a fourth. The impact of these issues varies from vegetable to vegetable and these factors are more an issue for fresh than processed vegetable exports. Australian vegetable growers may have cause for concern at the growth in trade in a number of frozen and processed vegetables, but may take some comfort in the low propensity to export fresh vegetables out of China.

What is the evidence to date on China's impact on Australian growers?

China is the second largest source country for vegetable imports into Australia. In general, Chinese vegetable products are at the lower end of the price spectrum so the volume or quantity share is likely to be higher. Table 2 shows the value and quantity of all vegetable imports from China with a total value over $1 million and ranked against the 2011-12 financial year. There were 16 vegetable products in this category. Dried vegetables, which are widely used in a number of other food preparations, was the major product imported in 2011-12. The most notable feature of the table is the strong preponderance of packaged vegetable products (largely canned) and snap frozen vegetables. This should not be a surprise to any Australian consumer that strolls down the aisles of Australian supermarkets. Only two fresh imports from China make the list - garlic and peas (snow and sugar snap peas). China dominates world production and trade for these two vegetables.

Looking at longer term trends, the value of Chinese imports in 2011-12 was $95 million, up sharply from 2001-02 when imports totalled only $35 million. But there has been no movement in China's relative position as a source of imports. A decade ago, China was also the second most important source country for imports. Indeed, last financial year, a mere $35,000 prevented China being forced back to third position as a source of imports. Nor has China's share of total imports risen dramatically. Last financial year China's share of total imports was 13.9%. In 2001-02, China's share of imports was 12.6%. The most notable change over the decade has been the rise in the relative importance of frozen vegetables. This may reflect better access to freezing facilities in rural China.

The Chinese obsession

In Australia, there is an obsession with anything Chinese. The popular press loves a story on China; Australians should lament the country being swamped with cheap Chinese product, while appreciating that their prosperity is dependent on Chinese economic growth. In the vegetable industry though, the Chinese obsession poses a wider danger.

Table 2 - Australia Vegetable Imports from China

Code	Unit	Description	Imports 2011-12	
			AUS $	Quantity
0712	KG	Vegetables, Dried No Added Preparation	15,883,497	4,944,092
071080	KG	Frozen vegetables other than beans, peas, potatoes, other leguminous vegetables, spinach and corn	13,029,544	13,297,049
200290	KG	Tomato Paste	10,851,028	11,765,494
070320	KG	Garlic, Fresh Or Chilled	9,816,250	8,337,576
071090	KG	Frozen Vegetable Mixtures	7,167,814	6,544,136
200310	KG	Prepared Agaricus Mushrooms(packaged)	6,168,342	3,544,174
120991	KG	Vegetable Seeds For Sowing	4,097,647	123,947
070810	KG	Peas, Fresh Or Chilled	4,069,680	1,295,486
200599	KG	Prepared Vegetables and Vegetable mixtures(packaged)	3,458,101	2,366,313
210320	L	Tomato Ketchup And Other Tomato Sauces	2,662,842	3,209,161
200190	KG	Vegetables/Fruit/Nuts Preserved by vinegar	2,333,561	1,257,745
200560	KG	Prepared Asparagus (packaged)	1,984,387	743,369
071022	KG	Frozen Beans	1,912,563	2,010,265
071040	KG	Frozen Corn	1,860,255	1,883,182
071030	KG	Frozen Spinach	1,713,624	1,493,624
200390	KG	Prepared non agaricus mushrooms, fungi and truffles	1,117,519	773,012

Source of Data: Australian Bureau of Statistics/GTIS Global Trade Atlas

Yet the surge in imports engulfing the Australian vegetable industry is not just a Chinese phenomenon. Chinese imports have risen dramatically over the decade and are up $60 million. But so have imports from a host of other countries. Imports from New Zealand are up $87 million, from $68m to $155m; the USA is up $59 million, from $36m to $95m; Italy is up $45 million from $40m to $85m; and the Netherlands is up $38 million from $14m to $52m. The USA, Canada, Mexico, the Netherlands, Belgium, Turkey, Argentina, Chile and South Africa have all been able to increase their share of import penetration of Australian domestic markets.

Clearly, wider market forces than just cheap Chinese product are at work. The pressure from imports is largely confined to frozen and processed vegetables. These are now globalised products and competition between countries to offload surplus vegetable production is increasing. It is the response to this import surge, rather than blaming cheap Chinese product, that needs to be addressed.

The future import threat from China

Australia is looking to develop the Chinese relationship further and supply more agricultural goods into China. There is the potential for export of vegetables to higher income earners in the major cities. But the markets are not easy, the logistics difficult and the relationships often fickle.

While there are opportunities, China has the potential to harm the Australian vegetable industry. China has already had a desultory impact as a cheap supplier of vegetables in some of Australia's key export markets. A key impact on the Australian vegetable industry will be the Chinese approach towards economic development in rural areas.

China's agriculture policy will be driven by food security concerns and maintaining political stability in rural China. In the face of rapid urbanisation, China is facing pressure on its food supplies as arable land is eaten up. The Chinese may welcome imports of land extensive agricultural products such as grain and livestock products to economise on land use. However, vegetable growing provides an outlet that is land intensive and surrounding markets with the potential for export. The Chinese are more likely to pursue development of their vegetable industry. Despite rising labour costs and the emergence of labour shortages due to the success of the one child policy, Chinese competition in world vegetable markets may intensify. And if the protracted negotiations between Australia and China over a Free Trade Agreement ever reach conclusion, don't expect many benefits to flow to Australian vegetable growers.

THE BOTTOM LINE

- Fears continue to grow surrounding China's short and long-term impact on the Australian vegetable industry.
- Pre packaged vegetables are the most common items imported from China to Australia, with garlic and peas standing as the only highly imported fresh vegetables.
- Clearer country of origin labelling is considered a key factor in arresting the flood of Chinese imports.

Ian James is an economist working in the vegetable industry. There is a wealth of economic information on the vegetable industry and more detail can be found on the AUSVEG website: ausveg.com.au/resources/industrystatistics.htm.
Project Number: VG11038

Appendix 4

National Skills and Training Desktop Review (report by Macquarie Franklin).

AUSVEG

Summary report on desktop review of training programs and tools in the vegetable industry

Skills & training scoping study for the vegetable industry

3 October 2012

MACQUARIE FRANKLIN

Consultants for business, agriculture and environment

MACQUARIE FRANKLIN
Consultants for business, agriculture and environment

Macquarie Franklin was formed in April 2011 by the merger of two Tasmanian based consulting firms - Agricultural Resource Management (ARM) and Davey & Maynard.

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Contents

Executive summary

This desktop review is the first stage of a vegetable industry skills and training scoping study that is being undertaken by Macquarie Franklin and Cat Conatus on behalf of AUSVEG. The second stage of the skills and training scoping study will be a survey of vegetable growers throughout Australia. The purpose of the vegetable industry skills and training scoping study is to enable AUSVEG to better target grower levy funds to actions which will improve the uptake of training and skills development in the vegetable sector.

The aim of this first stage is to review training programs and tools available to the Australian vegetable industry with the view to obtaining sufficient information to develop and implement the vegetable industry survey, and to enable an informed interpretation of the responses of growers to the survey.

This desktop study is a comprehensive review of existing literature on skills/training within the vegetable industry, and of training tools and programs for the vegetable industry. The range of topics covered includes:

- The current training landscape (perspective of state-based grower bodies and a review of previous studies on skills and training in the vegetable industry).
- A review of training programs (including University, VET and informal programs).
- A review of training/information tools (factsheets, calculators, case studies, ute guides, and databases).

Key findings from this desktop study are as follows:

- Growers tend to have an apathy towards training, and in the majority of cases, only participate for financial/market or legislative imperatives (finding supported by discussions with state vegetable bodies; ABARES; Regional Skills Development and the Agrifood Industries 2010; AgriFood Skill Australia – Business Skills Project 2000; and Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development 2007).
- Growers are more likely to undertake training in individual units rather than commit to a whole course/qualification (i.e. staggered or stepped training is more appealing) (finding supported by discussions with state vegetable bodies and Agrifood 2012 Regional Skills Development and the Agrifood Industries 2010).
- In most states, production horticulture is grouped with amenity horticulture in many VET courses, and the course being offered doesn't really meet the needs of the vegetable industry (finding supported by discussions with state vegetable bodies and AgriFood Skill Australia – Business Skills Project 2009).
- Lack of business and marketing skills in the farming community is a real concern for future growth and development of the vegetable industry (finding supported by discussions with state vegetable bodies; AgriFood Skill Australia – Business Skills Project 2009; and Australian

Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development 2007).

- Variable computer literacy of vegetable growers (finding supported by discussions with state vegetable bodies and ABARES).
- Language barriers are a major issue in some areas, both in terms of LOTE farming communities and also seasonal workers (often from overseas) (finding supported by discussions with state vegetable bodies).
- The delivery of training and extension programs to growers around the country is variable, although in the majority of cases it is either delivered by and/or co-ordinated by the state vegetable industry groups. In some states there appear to be strong partnerships between grower groups and state government primary industry/agriculture departments.
- While there are extension and training activities which cover on-ground technical aspects of farming and legal requirements (e.g. OH&S or WH&S), the scan has revealed limited opportunities for training in business skills (the exception to this was Queensland).
- The provision/ease of availability of tools and information to support skills improvement is highly variable across the country. Unlike training programs, there were many tools to assist in farm financial/business management that were revealed by our internet scan.
- The scan of tools/programs using our specific search methodology did not deliver some programs and tools that we are aware of being previously developed. Given the variable computer literacy of vegetable growers, and the fact that the majority of information is now distributed via the internet, the storage and availability of information on the web is a cause of concern.

Acknowledgements

The authors would like to thank representatives from state vegetable industry bodies across Australia who provided their time and expertise to the project team conducting this review. These people were: Mike Redmond (Grow SA); Michelle Templin and Scott Wallace (Growcom); Nick Steel and Mel King (TFGA); Jim Turley, Sarah Houston and John Shannon (Vegetables WA); Tony Imeson, Rod Hall and Helena Whitman (VGA Victoria); Denise Kreymborg (Bowen Gumlu Growers Association); Greg Weir (Bundaberg Fruit and Vegetable Growers); Mike Titley (Applied Horticulture Research, NSW), Alison Anderson (HAL), and Murray Spicer (NSW DPI).

1 Introduction

1.1 Background

This desktop review is the first stage of a vegetable industry skills and training scoping study that is being undertaken by Macquarie Franklin and Cat Conatus on behalf of AUSVEG. The second stage of the skills and training scoping study will be a survey of vegetable growers throughout Australia.

The aim of this first stage is to review training programs and tools available to the Australian vegetable industry with the view to obtaining sufficient information to develop and implement the vegetable industry survey. This desktop study is a comprehensive review of existing literature on skills/training within the vegetable industry, and of training tools and programs for the vegetable industry.

The purpose of the vegetable industry skills and training scoping study is to enable AUSVEG to better target grower levy funds to actions which will improve the uptake of training and skills development in the vegetable sector.

The lack of uptake of skills and training in the agricultural sector has been highlighted in a number of recent studies, some of which have been summarised in this review. The risk that this poses to the long term viability of the industry (including vegetable production was highlighted by AgForce in 2011 – "*the disconnect between increasingly complex agricultural systems managed by producers and the uptake of formal education is a significant risk that may, in the longer term, impact innovation and production system change, including adoption of new crop cultivars and livestock breeds which leads to higher productivity*"[1].

Recognising the low rate of skills and training uptake in the agricultural sector more broadly, this study aims to assist AUSVEG to identify barriers to training and skills development within the vegetable industry so progress can be made toward improving training outcomes for members.

The information presented in this report will enable an informed interpretation of the responses to the survey component of the vegetable industry skills and training scoping study. Topics covered in this report include:

- the current training landscape (perspective of state-based grower bodies and a review of previous studies on skills in and training);
- a review of training programs (including University, VET and informal programs);
- a review of training/information tools (factsheets, calculators, case studies, ute guides, and databases).

[1] Standing Committee on Education, Employment and Workplace Relations: Inquiry into meeting the education skills requirements for the agriculture sector in Australia, AgForce 8 November, 2011

1.2 Methodology

This desktop review was conducted via desktop research (primarily internet searches) and telephone discussions with representatives from vegetable grower organisations in each state.

1.2.1 Discussions with grower organisations

The organisations that were contacted as part of this study included:

- Growcom – Queensland
- VGA Victoria
- Grow SA
- TFGA – Tasmania
- Bowen Gumlu Growers Association
- Vegetables WA
- NSWFA
- Bundaberg Fruit and Vegetable Growers

Where additional contacts were provided during discussions these were also followed up (e.g. NSW DPI, HAL).

Grower organisation discussions were conducted to give a better understanding of the training "landscape" in each state – what types of programs are being delivered by whom, what kind of training is in demand from growers, what the issues are around training, what organisations deliver what kinds of training, working with growers who don't have English as a first language (LOTE), use of computers/technology amongst growers, etc.

Some states have recently prepared reports on skills and training in agriculture (e.g. Tas and Qld) – where available these were reviewed as part of this study (refer to section 2.2.4 for more information).

1.2.2 Internet searches

The Good Universities Guide (www.gooduniguide.com.au) was used to search for information on Universities and TAFEs, and information about other training programs was found through other searches (e.g. industry group websites, agriculture/primary industry department websites, etc). The AUSVEG and HAL websites were also searched for information relevant at a national level.

Tools and information which could be used by growers to increase their skills or knowledge were found by undertaking three types of internet searches:

- Google key word search.
- Search of grower websites and departmental (agriculture or primary industries) websites in each state.
- Search of AUSVEG website.

The rationale for this method of searching was that it was considered to be the main approach growers would adopt when searching for similar information.

2 Review of the skills and training landscape

The information presented in sections 2.1 and 2.2 below has been used to shape the questions developed for the vegetable industry grower survey that will be undertaken in the second stage of the AUSVEG skills and training scoping study. Section 2.1 contains an overview of the key themes arising from discussion with representatives from state-based vegetable industry grower bodies. Section 2.2 presents a review of previous studies on skills and training within the agriculture sector more broadly. Information specific to skills and training in the vegetable industry is highlighted where this was available from these studies. For the purposes of this study training is defined in a broad way to include a range of formal and informal learning opportunities. These encompass a mixture of accredited (nationally recognised training) and non-accredited courses, resources and tools.

2.1 Interviews with representatives from state-based grower bodies

Discussions with state-based vegetable grower organisations right across the country indicate that there is apathy towards training and in the majority of cases growers only participate in training for financial/market or legislative (e.g. OH&S) imperatives. The dollar value of training needs to be obvious to growers from the outset and in some states incentives (e.g. grants) have been used to encourage attendance at workshop programs.

In contrast, some states have found that charging growers a nominal attendance fee (e.g. to cover catering costs) has improved attendance at workshops and field days. It was suggested that having a small attendance fee encouraged growers to attend on the day.

Knowledge being passed on through families is still a very important component of training in many states and it was suggested that there is often a reluctance to put family members (or other staff) through traineeships or other forms of formal training.

In SA and Queensland the Farm Card model is being rolled out – this is a broad industry induction course (equivalent to induction card used for building industry).

The majority of state grower representatives noted that growers are more likely to undertake training in individual units rather than commit to a whole course/qualification (i.e. staggered or stepped training is more appealing). This can restrict access to funding, as most government funding is on a whole course basis, not a per unit basis.

Production horticulture courses offered through the VET system are grouped with amenity horticulture in most states. State grower representatives noted that this more generic horticultural course offering is not currently meeting the needs of the vegetable industry.

In some states, where agronomist/field officer/extension officer services are not readily available, growers are very dependent on external advice from advisors who stand to gain from product sales related to this advice (e.g. seed, chemical, fertiliser). There was some concern expressed by state grower representatives that this arrangement may lead to situations where growers are receiving advice that is not always in their best interests.

A lack of business and marketing skills among vegetable growers was nominated by many state-based organisations as a key factor limiting industry growth and development. Benchmarking groups are a common vehicle for the delivery of business and marketing skills in other agricultural industries (e.g. beef producer benchmarking groups). However, there was also almost unanimous agreement by state grower representatives that vegetable growers are reluctant to share information with each other. It was generally suggested that this reluctance was due to growers viewing each other as competitors without necessarily realising the potential benefits of greater industry collaboration.

Industry representatives painted a mixed picture of computer literacy rates among vegetable growers. In some areas growers are 'skipping' the internet and going straight to iphone/smartphone technology. There was some indication that growers find the constant flow of tools, books and factsheets overwhelming and often get someone else to find out information on their behalf (e.g. IDO, extension officer, advisor). There were comments that keeping track of old tools so new projects don't re-invent the wheel is important, but difficult to do (especially between states). We have included some examples of where this is happening already in Section 4.1.2, as potential models for other areas within the vegetable industry.

Some of the state grower organisations are registered training organisations (e.g. Growcom, Grow SA), while others are not. Those who are not often provide a liaison/coordination service to arrange workshops for their members on relevant topics (often in conjunction with state agriculture/primary industry departments). The level of training and extension services provided across Australia is highly variable. NSW is one of the few states to still have vegetable extension officers in the field; in SA by contrast there is no extension provided by the Department of Primary Industries and Regions to the vegetable industry.

Language barriers are a major issue in some areas, both in terms of Language Other Than English (LOTE) farming communities and also seasonal workers (often from overseas). In the case of the former these issues are being overcome in some areas by engaging with LOTE community leaders to assist local extension staff work with their communities, or employing extension officers who speak the language or are from the community. The issue with seasonal workers was problematic across the board, in all states, and no solutions to this problem were suggested.

The information above, provided by state-based grower bodies has been used to develop the grower survey. Following is a review of previous studies on skills and training in the vegetable industry. Findings from these previous studies have also been used to inform the development of the grower survey.

2.2 Previous studies on skills and training within the agriculture sector

This section provides a review of previous publicly available studies into skills and training in the agriculture sector more broadly, information specific to skills and training in the vegetable industry is highlighted where this was available. Many of the findings from these studies concur with each other and with the views of state grower body representatives reported in the previous section.

2.2.1 AgriFood 2012 Environmental Scan

Each year, AgriFood Skills Australia develops the Environmental Scan that sets out the factors impacting on the shape and capability of agrifood's workforce, and how well the training system its products and services are responding and additionally, what needs to happen in the future.

Key findings from the AgriFood 2012 environmental scan[2] relate to the agrifood industry more broadly. However, several themes relating to training and skills needs are relevant to the current survey:

- Building blocks / incremental skills development in addition to full qualifications.
- Innovative responses to the skill needs of non-traditional workforce, such as, seasonal labour, contractors and remote workers.
- Skills and training programs that are linked to the latest in industry innovations, increasing the uptake of research findings, new knowledge and technology.
- Delivery of skills and knowledge that enable workers to optimise new technologies, equipment and practices.

2.2.2 ABARES

ABARES, funded by Horticulture Australia Ltd., surveyed vegetable farms throughout Australia during 2006-07[3], 2008-09[4] and 2009-10[5]. The ABARES vegetable surveys covered a range of topics including education and training.

During the 2006-07 baseline survey (Table 1), attendance at field days was the most common form of education and training undertaken by Australian vegetable growers, with 72% of vegetable growers attending field days to improve their farm management and technical skills. Almost half of vegetable growers attended workshops and more than a third attended conferences. Only 12% of vegetable growers indicated they had attended a TAFE course during the baseline 2006-07 survey and only 1% had attended university.

[2] AgriFood Skills Australia 2012 Environmental Scan - http://www.agrifoodskills.net.au/?2012Scan

[3] Crooks, S 2009, Australian vegetable growing farms: an economic survey, 2006-07, ABARE Report to Horticulture Australia Ltd, Canberra, January.

[4] Crooks, S 2010, Australian vegetable growing farms: an economic survey, 2008-09, ABARE-BRS research report 10.12, Canberra, November.

[5] Thompson, T 2010, Australian vegetable growing farms: an economic survey, 2009-10, ABARES report to client prepared for Horticulture Australia Limited, Canberra, November.

Table 1: Education and training undertaken by vegetable growers, by state, 2006-07

	NSW	Vic	Qld	SA	WA	Tas	NT	Australia
Conferences	32%	44%	21%	37%	32%	58%	3%	**35%**
Field days	61%	86%	69%	57%	72%	90%	52%	**72%**
TAFE	25%	12%	8%	11%	2%	10%	4%	**12%**
University	0%	2%	1%	2%	0%	0%	0%	**1%**
Workshops	56%	52%	25%	47%	52%	56%	54%	**46%**
Other	11%	3%	10%	9%	16%	6%	0%	**9%**

Source: ABARES

During 2008-09 and 2009-10 survey participants reported undertaking a similar rate of education and training.

The 2006-07 baseline survey also captured information on the perceived usefulness of training and on the use of computers by vegetable growers.

Vegetable growers were asked which type of training would help them to develop their business. The types of training that were most commonly thought to be helpful included: training on crop types and varieties suitable for production (16%), soils and fertilisers (15%), disease management (15%), pest control (14%), marketing (13%) and irrigation and water supply (12%).

An estimated 82% of vegetable growers used a computer for the running of their business during 2006-07 (Table 2). The internet was most commonly used to assist vegetable growers to obtain weather information (67%) and manage their financial affairs (64%), while only 27% of growers used a computer to access educational resources.

Table 2: Use of computers in vegetable business, by state, 2006-07

	NSW	Vic	Qld	SA	WA	Tas	NT	Australia
Proportion of growers using a computer for								
Education resources	21%	28%	21%	25%	36%	37%	22%	**27%**
Financial affairs	62%	74%	59%	57%	64%	69%	47%	**64%**
Industry links	36%	50%	25%	31%	43%	56%	26%	**39%**
Market information	27%	54%	36%	27%	46%	44%	48%	**39%**
Media releases	12%	27%	11%	22%	38%	23%	3%	**20%**
Weather information	49%	79%	80%	57%	55%	72%	52%	**67%**
Purchasing farm inputs	3%	31%	29%	17%	35%	41%	3%	**25%**
Other	1%	2%	0%	15%	7%	6%	0%	**4%**

Source: ABARES

2.2.3 Other Reviews

2.2.3.1 Regional Skills Development and the Agrifood Industries (2010)[6]

- Resounding support was found for a "building blocks" approach to skills development. There is a strong view that there would be more engagement of industry with VET if skill sets were available.

- Evidence suggests that an approach that supports an incremental or building blocks approach to skills development is of benefit to both employers and individuals. Skill sets are acting as a hook into VET for employers and as a pathway to further learning and work for individuals.

- Building blocks are seen as an important pathway to qualifications. There should be focus on an increase in flexibility so that both skill sets and qualifications are available.

- The difficulties of accessing high quality training in regional, rural and remote areas are endemic and cut across industry sectors. But there are providers who are overcoming the challenges and doing it well – there is a need to learn from this.

- The policy landscape in relation to skill sets (as currently nationally defined) is confusing and inconsistent adding further challenges to the efforts being made by industry and training providers to partner in developing customised solutions.

- Analysis confirms Agrifood Skills Australia's contention about a move away from nationally recognised training and paints a picture of disengagement from qualifications by agrifood industries.

[6] National Quality Council 2010, Regional Skills Development and the Agrifood Industries, prepared for the National Quality Council by Lista Consulting and TVET Australia

2.2.3.2 AgriFood Skill Australia – Business Skills Project (2009)[7]

This study was a review of other skills development and training studies in the agrifood sector. Key findings:

- Research into the training needs of vegetable growers indicated that growers need skills in the general areas of business management, financial management, people management and marketing – particularly at Certificate IV level and above.
- The agricultural sector is characterised by low levels of participation in formal education and training.
- People who live in rural and regional areas face a number of barriers to participate in formal training. These include: fear; technology; time; cost; misperceptions; and low literacy levels.
- There is a belief among farmers that available courses do not meet their needs, and that training is often not available locally and is not sufficiently promoted.
- Even though they may not be participating much in formal education and training, farmers do still learn and update their skills – it's just that they do it informally. Social and business networks are valuable sources of information and learning.
- Vegetable growers generally do not access the courses and programs available in their industry because they are:
    - Generic in nature and do not specifically relate to the horticulture or vegetable industry.
    - Too lengthy (more than 2 days duration).
    - Inconveniently located.
    - Presented in unappealing ways.
    - People in the industry indicated a strong preference for experiential learning with a 'hands on' approach and a strong resistance to a teacher / classroom centred model for delivery.

[7] AgriFood Skills Australia Business Skill Project – Research Overview, prepared by the Ithica Group

2.2.3.3 Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development (2007)[8]

This report focused specifically on documenting the training needs for business skills and leadership in the vegetable industry. Key findings:

- Vegetable growers require more leadership and business management skills and these skills should be firmly tied to the profitability of the business.
- Training is occurring in an ad hoc manner with very little coordination between commodities.
- Skills are required in the general areas of business management, financial management, people management and marketing with a preference for high-level management skills.
- Identified needs in business management skills are based on business evaluation and planning, understanding costs of production and financial reports, better communication, developing negotiation and conflict resolution skills, improving decision making and managing change, and creating marketing opportunities.
- A key driver in growers' willingness to engage in training is the convenience of the training.
- Exposure to other growing regions and industries will create a greater willingness to participate.
- There is a preference for training delivery in small group workshops, grower study tours to other farms and visits to other businesses along the supply chain.
- While there are a large number of training programs available, many vegetable growers do not engage with this training.

[8] Australian Vegetable Industry Development Group 2007, Australian Vegetable Industry Training Needs Analysis in Business Skills & Leadership Development, prepared by Dianne Fullelove.

2.2.4 Review of State-based Agricultural Skills Plans

Some state governments have produced strategic plans concerning skills and training in agriculture, including Tasmania and Queensland.

2.2.4.1 Queensland

In Queensland there are two relevant reports:

- Agricultural Skills and Workforce Development Report 2012, by Queensland Department of Agriculture, Fisheries and Forestry (contracted by Skills Queensland).
- Horticulture 2020 - a cross-industry alliance to investigate and collectively address challenges currently limiting industry growth one of which is workforce development. Department of Employment, Economic Development and Innovation (DEEDI) working with Queensland horticulture. (www.daff.qld.gov.au/26_20485.htm).

Agricultural Skills and Workforce Development Report 2012

Key findings from this report, relevant to horticulture, include:

- Staff management and communication are valued as a core skill, likely due to the high casual and contract workforce.
- Two thirds of horticulture businesses indicate that there will be more technology used in the next 2-5 years.
- One third of businesses employ international labour.
- One third of horticulture businesses use contractors on a semi-regular basis.
- Need for the industry to have direct links to the RTOs delivering the courses, to ensure quality and capacity is reached.

Horticulture 2020

Key actions relating to workforce development listed in Horticulture 2020 include:

- Oversee the introduction of a Skills Passport/Yellow Card system.
- Develop linkages with Agribusiness Gateway Schools.

Both models will be piloted in Bowen and Bundaberg, in partnership with the Bowen District Growers Association and the Bundaberg Fruit and Vegetable Growers Association.

2.2.4.2 Tasmania

The Agricultural Industry Skills Plan 2011-2014 produced by RDS on behalf of TFGA and Skills Tasmania. This report identified 4 priorities for workforce development:

- Improve the perception of agriculture as a career option.
- Improve relevance and accessibility of training and career pathways into agriculture.
- Develop and promote career pathways for the increasing diversity of the workforce.
- Continued investment in skills development.

This report also identified key business management, technical (professional) and technical (operational) skills required.

3 Review of training programs

3.1 National training programs

3.1.1 AgriFood Skills Australia

AgriFood Skills Australia has developed a best practice delivery model designed to enhance the engagement of agrifood enterprise owners and improve their business skills. The model, entitled Growing Your Business, has been designed for small to medium enterprise owners and managers to enhance business skills through RTO-delivered training. The model seeks to equip business owners and trainers with the knowledge and skill to maximise business potential in six key areas:

- Financial management.
- Business management / business planning.
- Marketing.
- Managing staff.
- Business operations.
- Legal.

3.1.2 Rural Financial Counselling Service (RFCS)

The RFCS provides free, impartial and confidential financial counselling to help farmers, fishers and agriculture-dependent small businesses in their decision making. There is a Rural Financial Counselling Service in each state, although its usefulness appears to be variable depending on the support provided by state government (which is usually influenced by climatic/market conditions impacting growers). More information available at:
www.daff.gov.au/agriculture-food/drought/rfcs/counsellors

3.2 Degree courses

A recent study by the Australian Council of Deans of Agriculture[9] found that there is a sizeable job market in agriculture and more than 4,000 jobs per year are consistently being advertised seeking agricultural professionals. Conversely the number of graduates being supplied by Australian universities continues to decline significantly and is less than 20% of the number needed to satisfy the job market.

Conversations with state-based grower organisations indicated that generally only family/upper management in vegetable farms would have a degree or equivalent from a University. However, other jobs in the vegetable industry (such as field officers, agronomists, business advisors, etc) frequently require this level of qualification.

A search of the Good University Guide (website) has shown that courses with an agricultural content, ranging from business/economics and agronomy/farming practices are available at 11 universities around the country. These are summarised in the table below. Unfortunately the

[9] Australian Farm Institute 2012, Professional Agriculture – A case of supply and demand, Occasional Paper, No. 12.01

summary information on courses in agriculture from this website could not be used, as this included courses aimed at aquaculture and fisheries and forestry, which are not directly relevant to the vegetable industry.

Table 3: Summary of university courses relevant to agriculture in Australia

University	State	Overview of courses available
Charles Sturt University	NSW	Agribusiness, agriculture, horticulture
Curtin University	WA/NSW	Agribusiness, science and viticulture
La Trobe University	Vic	Agricultural science and business
Marcus Oldham College	Vic	Agribusiness and farm management
Murdoch University	WA	Plant biosecurity
University of Adelaide	SA	Agricultural science, global food and agribusiness
University of Melbourne	Vic	Agricultural science and agribusiness
University of New England	NSW	Ag economics, Rural Science, Business, Agriculture and precision agriculture
University of Queensland	Qld	Plant protection, rural systems, agricultural science and agribusiness
University of Sydney	NSW	Ag economics, business, agricultural science
University of Tasmania	TAS	Agricultural science
University of WA	WA	Agricultural science

Source: Good University Guide

3.3 Vocational Education Training (VET) & diploma courses

3.3.1 VET courses

A search of the Good University Guide (website) was used to identify TAFE institutions offering VET courses relevant to the vegetable industry. Most TAFEs offer traineeships or cadetships and recognition of prior learning (RPL) for some courses.

In a review of the VET workforce the Productivity Commission[10] noted that the VET system has moved from a provider-driven approach towards an industry-led system, whereby industry sets standards for competency. 'Industry' was defined as individual employers, as well as employer and employee peak bodies. While this change is a reflection of the current institutional and regulatory landscape: it is clear from discussions with state grower representative bodies (reported in section 2.1) that the skills and training available through the VET system is not currently meeting the needs of the vegetable industry.

Table 4 provides a summary of the number of institutions providing horticulture related courses in each state. Full details on course offerings by state TAFE institutions are presented in the Appendix.

[10] Productivity Commission 2011, Vocational Education and Training Workforce, Research Report, Canberra.

Table 4: Summary of institutions providing horticulture related courses in each state.

Course	Institute					
	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania
Advanced Diploma of Agribusiness Management	Yes	Yes				
Advanced Diploma of Agriculture	Yes	Yes				
Certificate II in Agriculture	Yes	Yes	Yes	Yes	Yes	Yes
Certificate II in Horticulture	Yes	Yes	Yes	Yes	Yes	Yes
Certificate II in Irrigation	Yes			Yes	Yes	
Certificate II in Production Horticulture	Yes				Yes	
Certificate III in Agriculture	Yes	Yes		Yes	Yes	Yes
Certificate III in Horticulture	Yes	Yes	Yes	Yes	Yes	Yes
Certificate III in Irrigation	Yes	Yes		Yes	Yes	
Certificate III in Production Horticulture	Yes	Yes	Yes		Yes	
Certificate IV in Agribusiness	Yes				Yes	
Certificate IV in Agriculture	Yes	Yes		Yes	Yes	Yes
Certificate IV in Horticulture	Yes	Yes	Yes	Yes	Yes	Yes
Certificate IV in Irrigation		Yes		Yes		
Certificate IV in Production Horticulture	Yes	Yes			Yes	
Diploma of Agribusiness Management	Yes	Yes	Yes		Yes	Yes
Diploma of Agriculture	Yes	Yes	Yes	Yes	Yes	Yes
Diploma of Horticulture	Yes	Yes	Yes	Yes	Yes	
Diploma of Irrigation		Yes		Yes		
Diploma of Production Horticulture		Yes		Yes		

Source: Good University Guide

3.4 Informal training programs

The range and type of informal training program varies considerably from state to state, hence they are summarised here by state. The search for these types of programs was undertaken through discussions with state-based organisations and brief searches of state government agriculture/primary industry departments in each state. There was a large variation in availability and types of programs being delivered around the country. The searches also found courses being offered by private industry (e.g. Rabobank business management programs [11], which are user-pays) and scholarships (e.g. Woolworths Agricultural Business scholarship[12]). It was beyond the scope of this study (and using our search methodology they were not easy to find) to identify all courses available through private providers and scholarships, however, there appear to be many opportunities available.

3.4.1 New South Wales

PROfarm courses are available through NSW DPI. Approximately 30 of the courses on offer may be of relevance to the vegetable industry. (http://www.dpi.nsw.gov.au/agriculture/profarm/courses). Some of the courses offered are accredited (e.g. various SMARTtrain chemical handling/use courses, forklift licence, chainsaw operation etc), while others are not. They cover a range of skills from technical (e.g. irrigation and soils) through to business.

NSW DPI extension staff also run field days and workshops as part of projects that they run, on technical topics relevant to farming. A model for vegetable industry benchmarking (VegBiz) is currently under development, and a greenhouse benchmarking project is also underway (also aiming to develop a benchmarking model).

NSW Farmers Association entered the farm training market in 2005, contracting experienced trainers to present workshops. Topics listed on their website include chemical accreditation.

3.4.2 Victoria

Short courses listed on the VGA Victoria website include forklift licence, farm chemical user, vegetable spray operator. These courses are not run by VGA Vic, but promoted by them. Uptake of apprenticeships is also promoted (www.vgavic.org.au/skills).

DPI Victoria is a RTO registered as AgTrain. Some courses offered are nationally recognised and accredited training (e.g. AgVet Chem user, CRM Chem Risk Management) others are non-accredited (e.g. Farm Plan 21, weedstop, post harvest handling, plant protection (IPM) EMS soil and water management).

DPI Victoria also host webinars on a range of topics of general interest (e.g. climate webinars series)

[11] www.rabobank.com.au/Rural/Education/Documents/Rabobank-EDP_Brochure.pdf

[12] www.woolworths.com.au/wps/wcm/connect/Website/Woolworths/About+Us/Community/Agricultural+Sponsorship/

3.4.3 Queensland

The Queensland government runs workshops, seminars and webinars with a business focus (go to www.business.qld.gov.au/business/tools-resources-support/mobile-office-business-industry). Growcom is a training provider and runs accredited and non-accredited courses (e.g. Freshcare, forklift training, centre pivot and linear move training). It also runs workshops on topical subjects for growers (e.g. workplace essentials seminars). Growcom surveys its members to determine what their training/information needs are. Some of the workshops offered are free, others are fee-based. In addition to Growcom, Queensland is also serviced by regional grower groups Bowen Gumlu Growers Association and Bundaberg Fruit and Vegetable Growers. Bundaberg Fruit and Vegetable Growers do offer fee-for-service training, although they are not registered as a RTO, so they work in with their local Agricultural College to deliver them. In addition, if they receive enquiries from growers on specific topics then they will run information sessions/workshops. Bowen Gumlu Growers Association also offers workshops on a range of topics including biosecurity, soil health, pest and disease and leadership.

3.4.4 South Australia

Based on the web search, South Australia has limited providers of workshops/training and extension activities for the vegetable sector. Grow SA is an RTO and is the major provider of accredited and non-accredited training (including both VET training and topical workshops/seminars on subjects of interest as required – e.g. changes to OH&S legislation, etc). In South Australia formats such as information lunches/breakfasts have tended to replace the traditional field day/workshop format. There are no field days extension services from either SARDI or Primary Industries and Regions. Grow SA work to fill this gap in South Australia – grower meetings are held to enable growers to have input into what they want/need.

3.4.5 Western Australia

Vegetables WA is not a RTO, however, information transfer to growers is a large part of what they do. They also often co-ordinate workshops in collaboration with Department of Agriculture and Food. They also run government funded projects which involve working with grower discussion groups on various topics (e.g. good practice projects funded through Caring for our Country). Vegetables WA are about to employ a Vietnamese extension officer to assist in working with the Vietnamese growers as language barriers have been a major barrier in working with this community.

The Drought Pilot Reform Program was a training program run by the Department of Agriculture and Food WA in 2011/2012. While it is not specifically targeted at vegetable growers, there has been very positive feedback about the four-day course that growers attended at different locations around WA. The program is set to continue in the future, http://www.daff.gov.au/agriculture-food/drought/drought-pilot.

There are very few private RTOs operating in WA, with those that are present mainly focussing on accredited courses such as chemical use, etc.

3.4.6 Tasmania

Tasmanian Farmers and Graziers Association is not a RTO but do co-ordinate workshops for growers where the need arises. The processing companies also play a role in grower education in Tasmania, running grower discussion groups and the occasional information session. The Department of Primary Industries Water and Environment now provide very little extension support/advice (including delivery of field days); this role has to some extent been filled by Tasmanian Institute of Agriculture (TIA) and private companies. There are very few private RTOs delivering accredited training in Tasmania. Tasmania appears to be one of the best serviced states in terms of on-ground one-on-one support for growers, with processing companies generally employing their own field staff. Merchandising companies (and fertiliser and chemical companies) also provide agronomists and many growers also engage the services of independent advisors.

4 Review of training tools

For the purposes of this study, training tools have been defined as any tools which can be used to upskill or educate vegetable growers. They include:

- Fact sheets or notesheets;
- Calculators or spreadsheets;
- Online calculators;
- Databases;
- Case studies.

4.1 National Overview

4.1.1 The Vegetable Industry Development Program

The Vegetable Industry Development Program (VIDP) aimed to deliver a coordinated and responsive research and development (R&D) program that meets the needs of growers in supporting a competitive and sustainable industry.
The VIDP

- Co-ordinated the delivery of key research outputs to vegetable growers, and
- Developed and delivered a range of resources to assist those in the vegetable industry to make better business decisions

The VIDP consisted of a number of sub-programs that worked together:

- Knowledge Management
- Consumers and Markets
- Economics
- People Development
- Integrated Pest Management
- InnoVeg
- Collaborative Industry Organisations
- Communications Support

Further information available at http://ausveg.com.au/rnd/intro.htm

The materials produced as part of the VIDP program and available on the AUSVEG website include fact sheets, business cases (including calculators) and materials for LOTE growers.

There are 18 business cases available on the VIDP website, some of which are excel calculators. They include IPM, cost comparison of buying vs using contractors, and labour management). There are 21 fact sheets, one of which is a gross margin calculator (VegTool). These range from business management to disease management.

Representatives from a few states mentioned VegTool, which is a gross margin tool for vegetable producers developed by Gerard Kelly at NSW DPI. This was an example of a tool which had a high awareness across states, and was well regarded.

There are 9 LOTE factsheets on topics including business management and spray application.

On the AUSVEG website there are other means of accessing technical information including technical insights and the R&D Insights database (http://ausveg.com.au/intranet/technical-insights/overview.htm).

The EnviroVeg case studies publication is a collection of farmer case studies on various topics relating to environmental management (ausveg.com.au/enviroveg/case_studies.htm).

4.1.2 Other examples of national data/information programs

Below are a few examples of tools available to growers and presented at a national level, which may provide a useful model for delivery of other tools/programs.

4.1.2.1 Infopest

Infopest was previously produced by the Queensland Department of Employment, Economic Development and Innovation (DEEDI) and is now owned and managed by Growcom. It is a combined Agvet and MSDS package which provides accurate, up-to-date information for the effective control of weeds, pests and diseases in a wide range of crops and livestock. It is available for purchase in CD-ROM format.
www.infopest.com.au

4.1.2.2 Pest Genie

Pest Genie is an online commercial provider of comprehensive up-to-date information on a broad range of chemical products, as well as a range of other information relating to their use. It is a web-based system which provides a full suite of tools to aid farm operation planning and management related to the storage and the use of pesticides and animal health products. It also includes a mobile phone App. Pay to subscribe to the on-line/smart phone based database.
www.pestgenie.com.au

4.1.2.3 Soil Quality

Using the tools provided on this website you can gain a greater understanding of the health of your soil, compare your data and examine soil relationships. It includes a database of soil test results in addition to factsheets.

Information is available for Western Australia, Tasmania, Queensland and South Australia. The database is managed by University of WA and Department of Agriculture and Food WA. The kinds of things growers can do on soil quality are:

- Examine soil properties through Australia's agricultural regions.
- Compare soil test results with neighbours.
- Investigate soil quality indicator relationships.
- Discover the importance of soil biology.

www.soilquality.org.au

4.1.2.4 Soil Health Knowledge Bank

The Soil Health Knowledge Bank was developed by the Australian Government DAFF to provide information on soil processes and properties. It has a range of case studies from different areas and enterprises, information on healthy soil, and a tool to diagnose your soil.
http://www.soilhealthknowledge.com.au

4.2 Overview of training tools by state

4.2.1 New South Wales

NSW DPI	Vegetable commodity growing guides. 15 factsheets	www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/commodity
	Vegetable diseases, pests & disorders. 5 IPM guides, 11 disease and disorders guides, 14 pest guides	www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/commodity
	Soil management. 6 factsheets, and 3 other guides/links	www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/soil
	Irrigation. 4 factsheets, 2 links to additional information & books	www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/irrigation
	Translated factsheets (Arabic, Chinese, Khmer and Vietnamese). Topics include pests and disease management; 10 factsheets for market gardeners on a range of topics; 4 factsheets on water use and chemical spraying; 4 factsheets on compost	www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/translated
	In the “bookshop” a large range of ute guides and booklets available for purchase on a range of topics	www.dpi.nsw.gov.au/aboutus/resources/bookshop
	Vegetable industry and business. 21 gross margin budgets for a range of crops	www.dpi.nsw.gov.au/agriculture/farm-business/budgets/vegetable
	Other cost guides & budget information, e.g. machinery, water	www.dpi.nsw.gov.au/agriculture/farm-business/budgets
	Budget templates (farm forms) in excel format	www.dpi.nsw.gov.au/agriculture/farm-business/budgets/templates
NSW Farmers	Link to VIDP tools	www.nswfarmers.org.au/policy_committees/horticulture/

4.2.2 Victoria

VGA Victoria	31 editions of Vege Notes (produced by AUSVEG). Topics range from IPM in different crops to spray application and various diseases.	www.vgavic.org.au/communication/vege_notes
	24 DPI Horticulture program factsheets (also on DPI Vic)	www.vgavic.org.au/communication/veg_mof
	R&D shop, with booklets and publications (including CD-ROM) available. Most free of charge.	www.vgavic.org.au/communication/research_and_development_shop
DPI Victoria	Information on vegetable production	www.dpi.vic.gov.au/agriculture/horticulture/vegetables
	11 Agnotes on various aspects of water use (e.g. irrigation scheduling, micro-irrigation), seedling production, IPM	
	Series of Agnotes on various pest insects and mites, weeds and plant disease	
	Farm water calculator, online tool for determining the annual farm water balance	
	Method for soil sampling and compost	

4.2.3 Queensland

Department of Agriculture Fisheries and Forestry (DAFF)	eResearch archive	www2.dpi.qld.gov.au/extra/era/index.html
	Vegetables web page. 9 vegetable crops with basic growing information. More detailed information under "producing horticultural crops" (11 different topics) ranging from energy efficiency in greenhouses to gross margins for vegetable crops (number of downloadable excel spreadsheets for range of different crops) and disease management. Some are books which need to be purchased, others are factsheets available free	www.daff.qld.gov.au/26_14819.htm
AgBiz Queensland	Agribusiness decision toolkit. Both business and finance tools and plant industry tools relevant to vegetable production. Business tools are export tools; farm operations tools and financial tools. All are excel calculators for range of situations (e.g. 11 farm operation tools include carbon foot print tool, boom spray calibration tool, machinery costing, planter calibration; 10 financial tools – including loan and equity calculators, farming budget template, lease calculator, etc)	http://agbiz.daff.qld.gov.au
	Vegetable tool is a range of gross margin calculators (excel) for range of different vegetable crops	
	Australian Farm Software directory Produced in 2007 and guide to ag software in Australia	www.daff.qld.gov.au/16_9303.htm

Growcom	Farm management systems - 12 factsheets on range of topics (e.g. farm safety, on-farm energy use, on-farm water use, etc)	www.growcom.com.au
	5 reef rescue case studies (, nutrient management & chemical management focus)	
	Water for Profit program - a number of factsheets and other information	
Bundaberg Fruit & Vegetable Growers	Workforce and training toolboxes	www.bfvg.com.au/index.aspx?page=61
	Materials from projects including biosecurity induction, succession planning	www.bfvg.com.au/index.aspx?page=51

4.2.4 South Australia

Primary Industries and Regions South Australia	Some information on biosecurity	www.pir.sa.gov.au/horticulture
Rural Solutions SA	Do not appear to have any information specific to horticulture or vegetables	www.ruralsolutions.sa.gov.au/home
South Australian Research and Development Institute	Some basic information on soils/irrigation and pest and disease. Mainly targeted to broadacre farming systems	www.sardi.sa.gov.au
growSA	No material freely available. Resources are available as part of training programs and do have these available in Vietnamese & Khmer	www.growsa.com.au

4.2.5 Western Australia

Department of Agriculture and Food	Vegetables page with factsheets (farmnotes) on the production of 12 vegetable crops	www.agric.wa.gov.au/PC_92676.html?s=1063276574,Topic=PC_92642
	Information on pests, weeds & disease	www.agric.wa.gov.au/PC_92727.html?s=518803424
	Farm notes on crop nutrition	www.agric.wa.gov.au/PC_92675.html?s=518803424
Vegetables WA	Good Practice Guide produced by vegetables WA, containing sections on nutrient management, water management, pest and disease management, biodiversity, and soil management	www.vegetableswa.com.au
	Online information on irrigation & water use & nutrient management	
	Vegetable Irrigation Scheduling System (VISS). A computer based tool to assist vegetable growers in scheduling irrigation for specific crops growing on the sandy soils of the Swan Coastal Plain (registration required to use)	www.vegetableswa.com.au/demo_home.asp

4.2.6 Tasmania

Department of Primary Industries Water and Environment (DPIPWE)	Wealth from Water Gross Margins for a range of fresh and processed vegetables; Farm Financial Management spreadsheets; Enterprise suitability toolkit for new irrigation districts (under development); Market research profiles Soil management soil erosion and control, soil sampling, soil structure, soil biology, irrigation, drainage & links to other soil booklets & publications (e.g. managing Tasmanian cropping soils) Water. Information about water resource management	www.dpiw.tas.gov.au
Tasmanian Institute of Agriculture (TIA)	Vegetable section and website generally has very limited materials available – controlled traffic farming adoption guidelines	www.tia.tas.edu.au
Tasmanian Farmers and Graziers Association	Processed vegetable gross margins; Property Management Planning - Financial Management Module; Water Requirement Spreadsheet	www.tfga.com.au

4.3 Summary of training tools

Table 5: Summary of training tools found via internet searches

State	Fact sheets	Farmer case studies	Calculators	Ute guides	LOTE information
NSW	Soils; Pest & disease; Crop growing guides; Irrigation	NA	Excel farm budget templates Veg crop gross margin calculators	Soil; Weeds; Pest & disease; IPM	Arabic, Chinese, Khmer and Vietnamese Pest & disease; Chemical use; Water use
Qld	Pests & disease; Crop growing guides; Farm safety; On-farm energy use	Reef rescue case studies	Business tools (cost comparisons of different management system); Excel farm budget templates; Veg crop gross margin calculators	NA	NA
SA	NA	NA	NA	NA	NA
Tas	Soils	NA	Farm Financial Management spreadsheets; Veg crop gross margin calculators; Water requirements spreadsheet	NA	NA
Vic	Pest & disease; IPM; Irrigation & water use; soil sampling	NA	Farm water calculator (online tool)	NA	NA
WA	Pest & disease; Vegetable production guides; Good Practice Guide (all aspects of vegetable growing); irrigation; nutrient management	NA	Vegetable Irrigation Scheduling System	NA	NA

NA not available/found using simple search criteria

The internet appears to be the main method by which many of the vegetable industry training tools are available. The familiarity of growers with computers and the internet will have a large influence on their ability to access and use many of the training tools currently available. When deciding on a search methodology we deliberately chose an approach that was similar to that growers would typically use when searching this type of information. As a result, it is likely that this review of tools is not entirely comprehensive. Consequently, there are tools that we are aware of that were not uncovered using this search methodology (for example factsheets and guides produced by Arris, Schofield Robinson and RMCG). This finding is important in itself and highlights a potential issue relating to the visibility and availability of relevant information and tools.

5 Conclusions

The information presented in this report will be used to assist in better interpreting the results from the grower survey, and it is in that context that it has been collected. While there are some preliminary recommendations that can be made at this stage, as discussed below, the majority of the information in this report will not be commented upon in isolation of the results from the grower survey.

5.1 Industry group engagement with the VET sector

One means of addressing the skills and training needs of vegetable growers is through influencing the Vocational Education and Training (VET) sector. The institutional framework covering the VET sector is complex. State and Territory Governments are responsible for VET, however, the Australian Government also plays a significant role through funding arrangements, regulation and direct program delivery.

- Each State and Territory Government has a training authority or department that administers VET.
- The Department of Education, Employment and Workplace Relations (DEEWR) is the Australian Government department that has oversight of the VET sector at a national level.
- Skills Australia is an independent statutory body that informs the various governing bodies of the VET sector about the skills needs of the economy.
- Skills Australia is supported by Industry Skills Councils that provide industry intelligence and advice, develop training packages and Aid the Australian Government in allocating places under the Productivity Places Program.
- AgriFood Skills Australia is the Industry Skills Council covering the national agrifood industry (including vegetables).
- The National Skills Framework is the national regulatory framework which promotes quality and national consistency in terms of qualifications and the delivery of training.
- A Training Package is an integrated set of nationally endorsed competency standards, assessment guidelines and Australian Qualifications Framework qualifications for a specific industry, industry sector, or enterprise.
- The only providers that can deliver nationally accredited content (usually that which is contained in the Training Packages) are Registered Training Organisations, which include a mixture of public (typically TAFE) and private providers.
- In order to become registered, training providers must meet Australian Quality Training Framework standards.

Industry bodies can influence VET through a number of channels including:

- Industry advisory arrangements.
- Partnerships with RTOs.
- The provision of VET.

Industry advisory arrangements

The vegetable industry could influence the VET sector through engagement with Industry Skills Councils in an industry advisory capacity, particularly with Agrifood Skills Australia.

AgriFood Skills Australia aim to progress skills and workforce development across five main sectors:

- Rural and related industries (including agriculture, horticulture, conservation and land management, animal care and management)
- Food, beverage and pharmaceutical processing
- Meat
- Seafood
- Racing (greyhound, thoroughbred and harness)

Each of these five sectors are represented by standing committees of business and industry stakeholders that consider issues such as industry skills and workforce innovation as well as the review of training products and services.

National Workforce Development Fund – 8,800 AgriFood training places. Priority areas:

- Sustainable practice
- Water Management
- Food Safety & Inspection
- Integrated Management Systems
- Biosecurity
- Biodiversity

Partnerships with RTOs

The vegetable industry could influence the VET sector through partnerships with RTOs. The National Centre for Dairy Education Australia (NCDEA) is one model of how such a partnership could work in practice and is presented as a case study at the end of this paper. NCDEA is an initiative of Dairy Australia formed in 2005 that delivers nationally accredited courses from Certificate II to Advanced Diploma in agriculture, food technology and food processing.

Provision of VET

Industry associations can also provide VET by seeking accreditation as an RTO enabling them to deliver nationally-recognised qualifications and access government funding. If it were a registered training provider, it is possible that AUSVEG could respond to identified skills and training needs by delivering nationally recognised qualifications specific to the vegetable industry.

In some states (e.g. Victoria) there are registered training organisations (RTOs) who provide a similar range of courses and units to TAFE. In other states there are few, if any, RTOs offering training in the agriculture sector (e.g. Tasmania). In some states (e.g. SA and Queensland) the state industry body is a registered RTO who provides training to industry. There is also collaboration between some TAFEs and RTOs - for example in Victoria the DPI is registered as a RTO and some joint sessions are run by the two organisations (eg AgVet Chem User course).

5.2 Conclusions from desktop survey results

The delivery of training and extension programs to growers around the country is variable, although in the majority of cases it is either delivered by or co-ordinated by the state vegetable industry groups. In some states there appear to be strong partnerships between grower groups and state government primary industry/agriculture departments, in others the grower groups bring in appropriate expertise as required. The scan has revealed that while there are extension and training activities which cover on-ground technical aspects of farming and legal requirements (e.g. OH&S or WH&S), the scan has revealed limited opportunities for training in business skills (the exception to this was Queensland, where DPI, formerly DEEDI, offer many training opportunities in this area). Whether these are being offered through other avenues which our search methodology did not identify or whether it does reflect a true gap in training in this area will be confirmed by the results of the grower survey. However, in either case it is cause for concern as business, financial, marketing and leadership skills were all listed by state representative bodies as being lacking in vegetable growers.

The provision/ease of availability of tools and information to support skills improvement is highly variable depending on the state. For example there was no relevant information readily accessible to vegetable growers in South Australia. Information in Tasmania was also limited while NSW and Queensland in particular had large amounts of material ranging from calculators to factsheets available. Interestingly, across the board, farmer case studies were not readily accessible on the internet except through the Enviroveg Program on the AUSVEG website. Unlike training programs, there were many tools to assist in farm financial/business management that were revealed by our internet scan. The scan of tools/programs using our specified search methodology did not deliver some programs and tools that we are aware of being previously developed. Given the variable computer literacy of vegetable growers, and the fact that the majority of information is now distributed via the internet, the storage and availability of information on the web is a cause of concern.

Appendix - Summary of TAFE courses of relevance to the vegetable industry, by State

Table 1A: Course offerings by New South Wales TAFE institutes

Course	Institute								
	Hunter	Illawarra	New England	North Coast	Northern Sydney	Riverina	South Western Sydney	Western	Western Sydney
Advanced Diploma of Agribusiness Management						Yes			
Advanced Diploma of Agriculture						Yes			
Certificate II in Agriculture	Yes	Yes	Yes	Yes		Yes		Yes	Yes
Certificate II in Horticulture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Certificate II in Irrigation									Yes
Certificate II in Production Horticulture			Yes	Yes		Yes			Yes
Certificate III in Agriculture	Yes	Yes	Yes	Yes		Yes		Yes	Yes
Certificate III in Horticulture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Certificate III in Irrigation						Yes			Yes
Certificate III in Production Horticulture				Yes		Yes			Yes
Certificate IV in Agribusiness						Yes			Yes
Certificate IV in Agriculture	Yes		Yes	Yes		Yes		Yes	Yes
Certificate IV in Horticulture			Yes	Yes	Yes	Yes			Yes
Certificate IV in Irrigation									
Certificate IV in Production Horticulture				Yes		Yes			
Diploma of Agribusiness Management						Yes			
Diploma of Agriculture		Yes	Yes	Yes		Yes		Yes	Yes
Diploma of Horticulture	Yes	Yes		Yes	Yes	Yes	Yes		Yes
Diploma of Irrigation									
Diploma of Production Horticulture									

Table 2A: Course offerings by Victorian TAFE institutes

Course	Institute											
	Advance	Bendigo	Chisholm	Central Gippsland	Gordon	Goulburn Ovens	Holmesglen	Kangan	Northern Melbourne	South West	Sunraysia	Wodonga
Advanced Diploma of Agribusiness Management										Yes		
Advanced Diploma of Agriculture						Yes						Yes
Certificate II in Agriculture	Yes				Yes	Yes			Yes	Yes		Yes
Certificate II in Horticulture	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Certificate II in Irrigation												
Certificate II in Production Horticulture												
Certificate III in Agriculture	Yes	Yes			Yes	Yes			Yes	Yes		Yes
Certificate III in Horticulture	Yes		Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes
Certificate III in Irrigation						Yes			Yes		Yes	
Certificate III in Production Horticulture						Yes					Yes	
Certificate IV in Agribusiness												
Certificate IV in Agriculture	Yes	Yes				Yes			Yes	Yes		Yes
Certificate IV in Horticulture			Yes	Yes	Yes	Yes	Yes		Yes	Yes		
Certificate IV in Irrigation						Yes					Yes	
Certificate IV in Production Horticulture											Yes	
Diploma of Agribusiness Management										Yes		
Diploma of Agriculture	Yes					Yes			Yes	Yes		Yes
Diploma of Horticulture			Yes	Yes		Yes	Yes		Yes	Yes		Yes
Diploma of Irrigation											Yes	
Diploma of Production Horticulture			Yes		Yes	Yes						

Table 2A: Course offerings by Queensland TAFE institutes

Course	Institute									
	Barrier Reef	The Bremer	Brisbane North	Central Queensland	Gold Coast	Metropolitan South	Southern Queensland	Sunshine Coast	Tropical North Queensland	Wide Bay
Advanced Diploma of Agribusiness Management										
Advanced Diploma of Agriculture										
Certificate II in Agriculture							Yes			
Certificate II in Horticulture	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes
Certificate II in Irrigation										
Certificate II in Production Horticulture										
Certificate III in Agriculture										
Certificate III in Horticulture	Yes	Yes	Yes	Yes				Yes	Yes	Yes
Certificate III in Irrigation										
Certificate III in Production Horticulture										Yes
Certificate IV in Agribusiness										
Certificate IV in Agriculture										
Certificate IV in Horticulture		Yes		Yes		Yes			Yes	Yes
Certificate IV in Irrigation										
Certificate IV in Production Horticulture										
Diploma of Agribusiness Management							Yes			
Diploma of Agriculture							Yes			
Diploma of Horticulture		Yes	Yes		Yes	Yes	Yes		Yes	Yes
Diploma of Irrigation										
Diploma of Production Horticulture										

Table 3A: Course offerings by South Australian TAFE institutes

Course	Institute				
	Barossa & Riverland	Eyre & West Coast	Metro	Southern regions	Yorke & northern regions
Advanced Diploma of Agribusiness Management					
Advanced Diploma of Agriculture					
Certificate II in Agriculture	Yes	Yes	Yes	Yes	Yes
Certificate II in Horticulture	Yes	Yes	Yes	Yes	Yes
Certificate II in Irrigation	Yes	Yes	Yes	Yes	Yes
Certificate II in Production Horticulture					
Certificate III in Agriculture	Yes	Yes	Yes	Yes	Yes
Certificate III in Horticulture	Yes	Yes	Yes	Yes	Yes
Certificate III in Irrigation	Yes	Yes	Yes	Yes	Yes
Certificate III in Production Horticulture					
Certificate IV in Agribusiness					
Certificate IV in Agriculture		Yes	Yes	Yes	Yes
Certificate IV in Horticulture	Yes	Yes	Yes	Yes	Yes
Certificate IV in Irrigation			Yes		
Certificate IV in Production Horticulture					
Diploma of Agribusiness Management					
Diploma of Agriculture	Yes	Yes	Yes	Yes	Yes
Diploma of Horticulture	Yes	Yes	Yes	Yes	Yes
Diploma of Irrigation			Yes		
Diploma of Production Horticulture			Yes		

Table 5A: Course offerings by Western Australia TAFE institutes

Course	Institute										
	CY O'Connor	Central	Challenger	Durack	Goldfields	Great Southern	Kimberly	Pilbara	Polytechnic West	South West	West Coast
Advanced Diploma of Agribusiness Management											
Advanced Diploma of Agriculture											
Certificate II in Agriculture	Yes			Yes	Yes	Yes	Yes			Yes	
Certificate II in Horticulture	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Certificate II in Irrigation						Yes					
Certificate II in Production Horticulture						Yes				Yes	
Certificate III in Agriculture	Yes			Yes	Yes	Yes					
Certificate III in Horticulture	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Certificate III in Irrigation						Yes				Yes	
Certificate III in Production Horticulture										Yes	
Certificate IV in Agribusiness	Yes										
Certificate IV in Agriculture	Yes			Yes	Yes	Yes					
Certificate IV in Horticulture			Yes			Yes				Yes	Yes
Certificate IV in Irrigation											
Certificate IV in Production Horticulture										Yes	
Diploma of Agribusiness Management	Yes										
Diploma of Agriculture	Yes			Yes	Yes	Yes					
Diploma of Horticulture			Yes			Yes				Yes	Yes
Diploma of Irrigation											
Diploma of Production Horticulture											

Table 6A: Course offerings by Tasmanian TAFE institutes

Course	Institute	
	Tasmanian Polytechnic	Tasmanian Skills Institute
Advanced Diploma of Agribusiness Management		
Advanced Diploma of Agriculture		
Certificate II in Agriculture	Yes	Yes
Certificate II in Horticulture	Yes	Yes
Certificate II in Irrigation		
Certificate II in Production Horticulture		
Certificate III in Agriculture	Yes	Yes
Certificate III in Horticulture	Yes	Yes
Certificate III in Irrigation		
Certificate III in Production Horticulture		
Certificate IV in Agribusiness		
Certificate IV in Agriculture	Yes	Yes
Certificate IV in Horticulture	Yes	
Certificate IV in Irrigation		
Certificate IV in Production Horticulture		
Diploma of Agribusiness Management	Yes	
Diploma of Agriculture	Yes	Yes
Diploma of Horticulture		
Diploma of Irrigation		
Diploma of Production Horticulture		