Horticulture Balanced Scorecard -Economic Assessment

Access Economics Pty Ltd

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Glossary

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
BFA	Biological Farmers of Australia
CSIRO	Commonwealth Scientific and Research Organisation
DCC	Department of Climate Change
DEEWR	Department of Education, Employment and Workplace Relations
FAO	Food and Agriculture Organization
FOB	Free on board
FTE	Full Time Equivalent
GSP	Gross State Product
GVP	Gross value of production
HAL	Horticulture Australia Limited
NGGI	National Greenhouse Gas Inventory
NRM	Natural Resource Management
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RSE	Relative Standard Error



1 Introduction

1.1 Background

Horticulture Australia Limited (HAL) commissioned Access Economics to undertake research to produce a Balanced Scorecard that compares the performance of the Australian horticultural industry against other agricultural industries across a range of economic, environmental and social parameters.

HAL is a national research, development and marketing organisation that works in partnership with the horticultural sector to invest in programs that provide benefit to the Australian horticultural industries. Its investments cover a range of topics across a diverse industry and are funded jointly through industry levies and public funds.

There is a growing awareness of the increasing competitiveness of the environment in which the national horticultural industry operates. Hence, the need to monitor and gauge the impact and return from industry activities and to rate both impact and return across subject areas and against other agricultural areas has increased. Having a tool such as the Balanced Scorecard will help HAL to better promote the Australian horticultural industry, increase public awareness, be prepared for future challenge and secure continuous support through Government.

1.2 The scope of the report

The report has been written as an explanatory note to the Balanced Scorecard, which is considered to be the main output. It outlines:

- the approach to selecting parameters for relative comparison and a final list of chosen parameters;
- a classification of the chosen parameters into broader descriptive categories;
- a definition of each of the chosen parameters;
- the approach to data collection and the allocation of the researched figures against the chosen parameters in the scorecard;
- references connecting each of the figures obtained to listed sources; and
- a reference list of sources used.

The report also discusses some of the parameters in more detail than done in the Balanced Scorecard.

1.3 Contents

Chapter 2 outlines the approach to selecting the parameters and the development of the assessment framework. Chapter 3 discusses data collection, data sources and relevant calculations needed to allocate research figures against the chosen parameters. Finally, Chapter 4 discusses each of the parameters researched and presents the Balanced Scorecard.



2 Framework development

2.1 Introduction

The framework development for the Horticulture Balanced Scorecard is based on the selection of both agricultural industries for comparison and the parameters across which those comparisons will be made. The selection of categories in both of these dimensions of the scorecard was made on the basis of what would provide the most interesting, relevant and accurate information.

2.2 Parameter selection

2.2.1 Government objectives

Government objectives, set out in policy documents, outline current priorities and policy issues. They serve as a useful gauge of the direction in which government intends to move. As such, they are particularly constructive in helping to identify areas of priority for analysis in this scorecard. By matching parameters to government objectives, it ensures that the data outlined in the scorecard is relevant to high level decision making.

An overview of Federal Government objectives relevant to the agricultural industry is outlined in Appendix A:. The objectives identified centre around a few main themes. These include:

- improving productivity of the industry and supply chain management;
- better management of natural resources;
- sustainable practices in the face of threats from climate change and biosecurity;
- reducing greenhouse gas emissions; and
- developing sustainable and efficient use of water.

These objectives focus mainly on environmental aspects of agriculture and have guided the selection of most environmental parameters.

Also identified is the objective to develop primary industry research via Rural Research and Development Corporations, Cooperative Research Centres, universities and the CSIRO. This objective is not specifically relevant to the scorecard parameters but is directly relevant to the funding of HAL.

2.2.2 HAL selected parameters

Further parameters are included in the scorecard due to HAL's priorities for analysis. These priorities are:

- the value of the information to the reader;
- areas where there will be significant differentiation between agricultural industries; and
- accuracy of estimates.



Essentially, this helps to target the parameters to those areas with the highest level of impact and accuracy, making the scorecard as relevant as possible given data constraints. As most detailed data refers to economic and social information, these priorities have mainly guided the selection of the economic and social parameters.

2.2.3 Final list of parameters for the balanced scorecard

From an initial broad list of parameters, a final list of parameters was selected based on the criteria outlined above. Parameters were grouped into broad categories where appropriate. The final list for inclusion in the balanced scorecard consists of the following parameters:

Economic parameters

Production

- Total area of production
- Total volume of production
- Total volume of production (average 2006-07 to 2008-09)
- Average volume of production per hectare
- Share of world volume of production
- Total volume of organic production
- Organic share of total volume of production
- Total gross value of production (GVP)
- GVP per employee
- GVP generated per hectare of production land used
- Industry GVP as a share of total agricultural GVP

Employment

- Total employment
- Median weekly wages
- Trade
 - Total wholesale trade value
 - Value of commodity exports (fob)
 - Exports per employee
 - Value of commodity imports
 - Net trade balance

Growth

- Past GVP growth (average 2003-04 to 2008-09)
- GVP growth forecast (2008-09 to 2010-11)

Farm details

- Total number of farm businesses
- Average number of employees per farm business
- Average land area per farm business
- Average GVP per farm business



- Farm business profit (average 2005-06 to 2007-08)
- Average rate of return (excl capital appreciation) to all capital used (average 2005-06 to 2007-08)
- Net capital additions, average per farm business
- Net capital additions, industry total
- GVP generated per \$ of net capital additions
- Total business expenditure on R&D (at farm level)
- Total business expenditure on R&D per GVP generated
- Average expenditure on R&D (at farm level) per farm business

Environmental parameters

Greenhouse gas emissions

- Total methane (CH₄) and nitrous oxide (N₂O) emissions (approximations)
- Total methane (CH₄) emissions
- Total nitrous oxide (N₂O) emissions (approximations)
- Average greenhouse gas (CO₂-e) emissions per tonne of output
- Total greenhouse gas (CO₂-e) emissions per GVP generated
- Total methane (CH₄) emissions per GVP generated
- Total nitrous oxide (N₂O) emissions (approximations) per GVP generated

Resource use – land and water

- Total water use
- Average water use per hectare
- Average water use per GVP generated
- Average hectares of production land used per GVP generated

Social parameters

- Location
 - Main production state based on % of industry GVP
 - Urban production
 - GVP generated in urban areas
- Other social parameters
 - Demographic profile of employees
 - Farm use of internet
 - Percentage female to male employees
 - Full-time versus part-time/casual/seasonal employment

2.3 Industry selection

The agricultural industries included in the scorecard were selected by HAL. Their concordance with ANZSIC categories is outlined Table 2.1. While most scorecard categories match ANZSIC classifications, there are difficulties in distinguishing wool growing from sheep farming and, in some cases, viticulture from horticulture.



Scorecard categories	ANZSIC classifications
Horticulture	011 Nursery and Floriculture Production (including all subsectors) 012 Mushroom and Vegetable Growing (including all subsectors) 013 Fruit and Tree Nut Growing (including all subsectors except for 0131 Grape Growing)
Viticulture (Wine and table grapes)	0131 Grape Growing
Sheep and beef cattle	 014 Sheep, Beef Cattle and Grain Farming subsectors: 0141 Sheep Farming (except for Wool growing) 0142 Beef Cattle Farming (Specialised) 0143 Beef Cattle Feedlots (Specialised) 0144 Sheep-Beef Cattle Farming 0145 Grain-Sheep or Grain-Beef Cattle Farming (except for grain growing)
Wool	'Wool growing' is included in 014 Sheep, Beef Cattle and Grain Farming subsector 0141 Sheep Farming.
Rice	014 Sheep, Beef, Cattle and Grain Farming subsector: – 0146 Rice Growing
Grains	 014 Sheep, Beef, Cattle and Grain Farming subsector: 0149 Other Grain Growing (e.g. wheat, barley, cereal grain, lupin, oat, pasture seed, sunflower, etc.) 'Grain growing' is also included in 014 Sheep, Beef Cattle and Grain Farming subsector 0145 Grain-Sheep or Grain-Beef Cattle Farming.
Sugar	015 Other Crop Growing subsector: – 0151 Sugar Cane Growing
Cotton	015 Other Crop Growing subsector: – 0152 Cotton Growing
Dairy Cattle	016 Dairy Cattle Farming
Poultry	017 Poultry Farming subsector: – 0171 Poultry Farming (Meat)
Eggs	017 Poultry Farming subsector: – 0172 Poultry Farming (Eggs)
Pig	019 Other Livestock Farming subsector: – 0192 Pig Farming

Table 2.1: Industry classification

Source: ABS (2006) Note: Remaining agricultural categories not included in this table are: 015 Other Crop Growing subsector 0159 Other Crop Growing n.e.c.; 018 Deer Farming (including all subsectors); and 019 Other Livestock Farming subsectors 0191 Horse Farming; 0193 Beekeeping; 0199 Other Livestock Farming n.e.c.



3 Data sources

Based on the parameters agreed upon between HAL and Access Economics, data was collected from a variety of sources. Primarily relevant government statistics databases were used, such as the Australian Bureau of Statistics (ABS), the Australian Bureau of Agricultural and Resource Economics (ABARE), the Department of Climate Change (DCC) and the Department of Education, Employment and Workplace Relations (DEEWR). Government databases were relied upon to cater for the majority of parameters to ensure robustness of the data and consistency across agricultural industries.

The ABS provided a summary of current ABS agriculture publications as well as a list of potential sources outside of the ABS (ABS, 2010), which were used as a starting point to search for data. The DEEWR SkillsInfo website also provided useful data on employment and labour force within the particular agricultural industries, and compensated for the fact that some ABS surveys did not cover the agricultural sector (such as the ABS 2008 Survey of Employee Earnings and Hours). In addition, other sources were used such as workers compensation data from Safe Work Australia, and organic production data from the Biological Farmers of Australia.

A list of the economic, environmental and social parameters is shown in Table 3.2 to Table 3.4 along with the data source, data year, and a brief explanation of calculation methodologies. Where data included disaggregated industries aligned with the 4-digit ANZSIC codes, the concordance presented in Table 2.1 was followed. However, the majority of data did not present wool separately from the sheep/cattle category, and as such wool estimates were included in the sheep/beef category. However, where the data was disaggregated, wool was listed separately, and the sheep/cattle category did not include wool.

Where data only disaggregated the industries by 3-digit ANZSIC codes, the concordance used in Table 3.1 was used. For example, the estimates for 015 Other Crop Growing were used to represent the sugar and cotton industries. In addition, a weighted average of the three ANZSIC categories of 011 Nursery floriculture production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing were used to calculate estimates for the horticulture and viticulture industry.

ANZSIC 3 digit codes	Balanced scorecard categories
011 Nursery floriculture production	Horticulture
012 Mushroom and Vegetable Growing	Viticulture
013 Fruit and Tree Nut Growing	
014 Sheep, Beef Cattle and Grain Farming	Sheep/Beef
	Wool
	Rice
	Grain
015 Other Crop Growing	Sugar
	Cotton
016 Dairy Cattle Farming	Dairy Cattle

Table 3.1: Concordance between 3-digit ANZSIC codes and balanced scorecard categories



017 Poultry Farming	Poultry
	Eggs
018 Deer Farming	n/a
019 Other Livestock Farming	Pigs

Source: Access Economics

Table 3.2: Economic parameters – data sources and calculations

	Parameter	Data source	Year / Calculations
1	Total area of production	ABS (2010)	2008-09 data
	(hectares)	Cat No 7121.0	Estimates were calculated by summing categories based on 4-digit ANZSIC codes. The data showed the number of agricultural businesses within a size range (i.e. there were 711 grape-growing agricultural businesses with an area of holding between 50 and 100 ha). Therefore an average of the range bounds was multiplied by the number of agricultural businesses within that range to determine total hectares.
2	Total volume of production	ABS (2010)	2008-09 data
	(tonnes)	Cat No 7121.0; ABS (2010) Cat No 7215.0	Production figures for horticulture, viticulture, rice, grain, sugar and cotton were obtained from ABS Cat No 7121.0 Agricultural Commodities, Australia, 2008-09. Production figures for sheep/beef, poultry and pigs were obtained from 7215.0 - Livestock Products, Australia and refer to red meat produced in 2008-09.
3	Total volume of production	ABS (2010)	2006-07 to 2008-09 data
	(average 2006-07 to 2008-09) (tonnes)	Cat No 7121.0; ABS (2010) Cat No 7215.0	Estimates were obtained as for parameter 2; three year average for all categories except viticulture, wool, rice, dairy and eggs.
4	Average volume of production	ABS (2010)	2008-09 data
	per hectare (tonnes per hectare)	Cat No 7121.0; ABS (2010) Cat No 7215.0	Estimates were calculated by dividing total volume of production by total area of production.
5	Share of world volume of	FAO (2009)	2007 data
	production (%)		Estimates were calculated by dividing total volume of production by world volume of production.
6	Total volume of organic	Biological	2008 data
	production (tonnes)	Farmers Australia (2008)	Estimates taken from report. Note that horticulture includes volume of production from viticulture, and the beef/sheep category only includes the volume of production from beef.



	Parameter	Data source	Year / Calculations
7	Organic share of total volume of	Biological	2008 data
	production (tonnes)	Farmers Australia (2008)	Estimates were calculated by dividing total volume of organic production by total volume of production.
8	Total gross value of production	ABARE (2010)	2008-09 data
	(GVP) (\$ million)		Production figures from ABARE Australian Commodities March Quarter, Table 21 Gross value of farm and fisheries production.
9	GVP per employee (\$ per	ABARE (2010);	2008-09 data
	employee)	ABS (2006) Cat No 2068.0	Estimates were calculated by dividing total gross value of production by total employment.
10	GVP generated per hectare of	ABARE (2010);	2008-09 data
	production land used (\$ per hectare)	ABS (2010) Cat No 7121.0	Estimates were calculated by dividing total gross value of production by total area of production.
11	Industry GVP as a share of total	ABARE (2010)	2008-09 data
	agricultural GVP (%)		Estimates were calculated by dividing industry gross value of production by total agricultural gross value of production.
12	Total employment (number of	ABS (2006)	2006 data
	persons employed)	Cat No 2608.0	Estimates were calculated by summing categories based on 4-digit ANZSIC codes.
13	Median weekly wages (\$, before	DEEWR	2008 data
	təx)	(2008), Skills Info, Industry Profiles, Earnings	DEEWR provided statistics at 3-digit ANZSIC codes. For horticulture and viticulture, a weighted average of the three ANZSIC subdivisions of 011 Nursery Floriculture Production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing was calculated based on employment data.
14	Total wholesale trade value (\$	ABS (2008)	2006-07 data
	million)	Cat No 7125.0	Estimates were calculated by aggregating/ disaggregating gross value of production data to national level and into appropriate industries Agricultural Commodities, Small Area Data
15	Value of commodity exports	ABARE (2010)	2008-09 data
	(fob) (\$ million)		Estimates were calculated by summing categories.
16	Exports per employee (\$)	ABARE (2010); ABS (2006)	2008-09 data (Note: employees based on 2006 levels)
		Cat No 2608.0	Estimates were calculated by dividing total value of commodity exports by total employment.
17	Value of commodity imports (\$	ABARE (2010)	2008-09 data
	million)		Estimates were calculated by summing categories.
18	Net trade balance (\$ million)	ABARE (2010)	2008-09 data
			Estimates were calculated by deducting imports from exports.



	Parameter	Data source	Year / Calculations
19	Past GVP growth (average 2003-	ABARE (2010)	2003-04 to 2008-09 data.
	04 to 2008-09) (% per annum)		Percent growth rate was calculated by comparing 2003-04 with 2008-09 data. Annual average over five year period.
20	GVP growth forecast (2008-09 to	ABARE (2010)	2008-09 data, forecasts for 2009-10 and 2010-11
	2010-11) (% per annum)		Percent growth rate was calculated by comparing 2008-09 with 2010-11 data. Annual average over two year period.
21	Total number of farms	ABS (2010)	2008-09 data
	businesses	Cat No 7121.0	Estimates were calculated by summing categories based on 4-digit ANZSIC codes.
22	Average number of employees	ABS Cat No	2006 data
23	per farm business (number of persons employed per farm, 2006 average)	(2006) 2608.0; ABS Cat No 7121.0 (2005- 06)	Estimates were calculated based on number of farms and employment figures, using 2005-06 data for consistency.
23	Average land area per farm	ABS (2010)	2008-09 data
	business (hectares)	Cat No 7121.0	Estimates were calculated by dividing total area of production by the number of farms.
24	Average GVP per farm business	ABARE (2010);	2008-09 data
	(\$)	ABS (2010) Cat No 7121.0	Estimates were calculated by dividing the total gross value of production by number of farms.
25	Farm business profit (average	ABARE (2009)	2005-06 to 2007-08 data
	2005-06 to 2007-08) (\$ per annum)		The ABARE Farm Survey provided data for the industries of grain crops, mixed crop-livestock, beef, sheep, sheep beef (covering properties engaged in running sheep and beef cattle) and dairy. Data provided by the ABARE Vegetable Farm Survey provided data for 2007-08 on vegetable farms. Vegetable farms were taken to represent the horticulture farm profit (omitting fruit). Grain crops represented the grains industry and dairy represented the dairy cattle industry. A weighted average of beef, sheep and sheep beef statistics based on number of farms



	Parameter	Data source	Year / Calculations				
26	Average rate of return (excl capital appreciation) to all capital used (average 2005-06 to 2007- 08) (%)	ABARE (2009)	2005-06 to 2007-08 data The ABARE Farm Survey provided data for the industries of grain crops, mixed crop-livestock, beef, sheep, sheep beef (covering properties engaged in running sheep and beef cattle) and dairy. Data provided by the ABARE Vegetable Farm Survey provided data for 2007-08 on vegetable farms. Vegetable farms were taken to represent the horticulture rate of return (omitting fruit). Grain crops represented the grains industry and dairy represented the dairy cattle industry. A weighted average of beef, sheep and sheep beef statistics based on number of farms was used for the sheep/beef industry.				
27	Net capital additions, average per farm business (\$ per annum)	ABARE (2009)	2007-08 data The ABARE Farm Survey provided data for the industries of grain crops, mixed crop-livestock, beef, sheep, sheep beef (covering properties engaged in running sheep and beef cattle) and dairy. Data provided by the ABARE Vegetable Farm Survey provided data for 2007-08 on vegetable farms. Vegetable farms were taken to represent the horticulture rate of return (omitting fruit). Grain crops represented the grains industry and dairy represented the dairy cattle industry. A weighted average of beef, sheep and sheep beef statistics based on number of farms was used for the sheep/beef industry.				
28	Net capital additions, industry total (\$ million per annum)	ABARE (2009); ABS (2010) Cat No 7121.0	2007-08 data (Note: number of farms based on 2008-09 data) Estimates were calculated by multiplying per- farm average net capital additions by total number of farms.				
29	GVP generated per \$ of net capital additions (\$ per annum)	ABARE (2009); ABARE (2010)	2007-08 data Estimates were calculated by dividing total net capital additions by total gross value of production.				
30	Total business expenditure on R&D (at farm level) (\$ '000s)	ABS (2009) Cat No 8104.0	2007-08 data Estimates were calculated by summing categories based on 4-digit ANZSIC codes.				
31	Total business expenditure on R&D per GVP generated (\$ per \$ million)	ABS (2009) Cat No 8104.0; ABARE (2010)	2007-08 data (both ABS and ABARE) Estimates were calculated by dividing total business expenditure on R&D by total gross value of production				



	Parameter	Data source	Year / Calculations
32	Average expenditure on R&D (at farm level) per farm business (\$)	ABS (2009) Cat No 8104.0; ABS (2010) Cat No 7121.0	2007-08 data (Note: number of farms based on 2008-09 data) Estimates were calculated by dividing total business expenditure on R&D by total number of farms.

Table 3.3: Environmental parameters - data sources and calculations

	Parameter	Data source	Year / Calculations
33	Total methane (CH ₄) and	DCC NGGI	2007 data
	nitrous oxide (N_2O) emissions (approximations) (tonnes of CO ₂ -e per year)	(2009)	Sum of methane and nitrous oxide emissions.
34	Total methane (CH ₄) emissions	DCC NGGI	2008 data
	(tonnes of CO ₂ -equivalent per year)	(2010)	Estimates were calculated by summing categories and applying emissions factors (21 categories for methane to calculate CO ₂ -e emissions).
35	Total nitrous oxide (N ₂ O)	DCC NGGI	2007 data
	emissions (approximations) (tonnes of CO_2 -e per year)	(2009)	Estimates were calculated by summing categories and applying emissions factors (310 categories for nitrous oxide to calculate CO ₂ -e emissions).
36	Average greenhouse gas (CO ₂ -e) emissions per tonne of output	DCC NGGI	2007 data
		(2009)	Estimates were calculated by summing methane and nitrous oxide emissions dividing by total volume of production
37	Total greenhouse gas (CO ₂ -e) emissions per GVP generated (tonnes of CO ₂ -e/\$ million per year)	DCC NGGI	2007 data
		(2009)	Estimates were calculated by dividing total methane and nitrous oxide emissions by GVP generated.
38	Total methane (CH ₄) emissions	DCC NGGI	2008 data
	per GVP generated (tonnes of CO ₂ -e/\$ million per year)	(2010)	Estimates were calculated by dividing total methane emissions by GVP generated.
39	Total nitrous oxide (N ₂ O)	DCC NGGI	2007 data
	emissions (approximations) per GVP generated (tonnes of CO ₂ - e/\$ million per year)	(2009)	Estimates were calculated by dividing total nitrous oxide emissions by GVP generated.
40	Total water use (megalitres)	ABS (2010) Cat	2008-09 data
		No 4618.0	Estimates were summed based on relevant industry categories. For horticulture, a weighted average of the divisions of fruit and nut, vegetables for human consumption, and nurseries was taken based on the number of agricultural businesses. Water use for pasture for grazing was taken to represent the sheep/beef and dairy cattle industry



	Parameter	Data source	Year / Calculations
41	Average water use per hectare	ABS (2010) Cat	2008-09 data
42	(megalitres/hectare)	No 4618.0	Estimates were summed based on relevant industry categories. For horticulture, a weighted average of the divisions of fruit and nut, vegetables for human consumption, and nurseries was taken based on the number of agricultural businesses. Water use for pasture for grazing was taken to represent the sheep/beef and dairy cattle industry.
42	Average water use per GVP	ABS (2010) Cat	2008-09 data
	generated (ML/\$ million)	No 4618.0; ABARE (2010)	Estimates were calculated by dividing total water use by GVP generated.
43	Average hectares of production	ABARE (2010);	2008-09 data
-13	land used per GVP generated (ha/\$ million)	ABS (2010) Cat No 7121.0	Estimates were calculated by dividing total area of production by GVP generated.

Table 3.4: Social parameters - data sources and calculations

	Parameter	Data source	Year / Calculations
44	Main production state based	ABS (2008) Cat	2006-2007 data
	on % of industry GVP (leading production state, and % of industry GVP produced there)	NO 7125.0 (by NRM)	Estimates were calculated by aggregating/ disaggregating gross value of production data into appropriate industries. This was done at State level. Then the State with the highest value was selected and the proportion of the total value produced in that State was calculated for each industry.
45	Urban production (% of GVP	ABS (2008) Cat	2006-07 data
	produced in urban areas and surrounds)	No 7125.0 (by NRM)	Estimates were calculated by aggregating/ disaggregating gross value of production data into appropriate industries. This was done at national level and for the capital city NRM in each State (except NT), giving the "urban" NRMs. Note: the ACT has only one NRM and this was considered urban. The overall value of urban production was aggregated to a national level by summing the value in all urban NRMs. For each industry, the overall urban value was divided by the national value of production to give the proportion produced in urban area and surrounds.
46	GVP generated in urban areas	ABS (2008) Cat No 7125 0 [.]	2006-07 data (Note: GVP based on 2008-09 data)
	areas and surrounds)	ABARE (2010)	Estimates were calculated by multiplying urban production % of GVP and total gross value of production.



	Parameter	Data source	Year / Calculations			
47	Demographic profile of employees (median age)	DEEWR (2009) SkillsInfo, Industry Profiles, Median Age	2009 data DEEWR provided statistics at 3-digit ANZSIC codes. For horticulture, a weighted average of the three ANZSIC subdivisions of 011 Nursery Floriculture Production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing was calculated based on employment. Viticulture was based on the 013 Fruit and Tree Nut Growing average.			
48	Farm use of internet (% farms using internet)	ABS (2009) Cat No 8150.0	2007-08 data ABS provided statistics at 3-digit ANZSIC codes. For horticulture and viticulture, a weighted average of the three ANZSIC subdivisions of 011 Nursery floriculture production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing was calculated based on employment.			
49	Percentage female to male employees (% female)	DEEWR (2010) SkillsInfo, Industry Profiles	2010 data DEEWR provided statistics at 3-digit ANZSIC codes. For horticulture, a weighted average of the three ANZSIC subdivisions of 011 Nursery Floriculture Production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing was calculated based on employment. Viticulture was based on the 013 Fruit and Tree Nut Growing average.			
50	Full-time versus part- time/casual/seasonalDEEWR (2010)time/casual/seasonalSkills Info, Industryemployment (% full-time share of total employment)Industry Profiles		2010 data DEEWR provided statistics at 3-digit ANZSIC codes. For horticulture, a weighted average of the three ANZSIC subdivisions of 011 Nursery Floriculture Production, 012 Mushroom and Vegetable Growing and 013 Fruit and Tree Nut Growing was calculated based on employment. Viticulture was based on the 013 Fruit and Tree Nut Growing average.			



4 Balanced Scorecard

Having sourced the relevant data, this chapter discusses the parameters across a range of agricultural industries for comparison with horticulture. Section 4.1 discusses the economic, social and environmental parameters in detail, while Section 4.2 presents the balanced scorecard, which summarises those parameters in a matrix format. Finally, Section 4.3 highlights particular strengths and weaknesses of the horticultural industry.

4.1 Discussion of parameters

4.1.1 Economic parameters

Production

1 - Total area of production

The agricultural industries in the scorecard occupied around 473,740 hectares of land in 2008-09. Sheep/beef farms cover by far the largest area (406 million hectares). Horticultural farms cover 2.4 million hectares, which accounts for 0.5% of the farmland (Table 4.1).

Table 4.1: Total land area of production ('000 hectares, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
2,446	888	406,121	n/a	94	57,695	1,114	1,739	2,834	99	106	604

Source: ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

High reliance on number of farms' data that had high Relative Standard Errors (RSEs), with most having RSE between 10-50%, with some over 50%. Data should be treated with caution. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality assured. The resultant value estimates have been checked against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.

2 - Total volume of production

In terms of volume of production, grains and sugar are the largest industries with outputs of 35.8 million tonnes and 31.5 million tonnes respectively (a combined 79% of production volume). Horticulture produces 3.5 million tonnes of produce in a year and accounts for around 5% of the output in the agricultural industries included in the scorecard (Table 4.2).

Table 4.2: Volume of production ('000 tonnes, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
3,509	113	2,543	371	61	35,821	31,457	309	9,671	832	162	324

Source: ABS (2010) Cat No 7121.0; Note: Eggs based on FAO data (2007); Milk: 9.7 million tonnes is equivalent to 9,389 million litres.

Rice estimates had a RSE from 10-25%; viticulture estimates had a RSE from 25-50%, and should be treated with caution. Other estimates had RSEs less than 10%. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality assured. The resultant value estimates have been checked



against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.

3 - Total volume of production (average 2006-07 to 2008-09)

Looking at volume of production over the past three years, results are similar to 2008-09 alone figures in terms of relative magnitudes. Horticulture, sugar and pig production volumes have been somewhat higher in the past three years than in 2008-09 alone, while sheep/beef, grains, cotton and poultry production volumes were stronger in 2008-09 than in the years prior (Table 4.3).

Table 4.3: Volume of production ('000 tonnes, average 2006-07 to 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
3,537	n/a	1,661	n/a	n/a	27,290	33,491	237	n/a	331	n/a	384

Source: ABS (2010) Cat No 7121.0. Note: n/a – not available.

Estimates had RSEs less than 10%. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality assured. The resultant value estimates have been checked against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.

4 - Average volume of production per hectare

Sugar, poultry, dairy cattle and horticulture are the industries that are most efficient in land use relative to tonne of production (Table 4.4). Horticulture produces an average 1.43 tonnes of output for every hectare of farm land.

Table 4.4: Average volume of production (tonnes per hectare, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
1.4	0.1	0.01	n/a	0.7	0.6	28.2	0.2	3.4	8.4	n/a	0.5

Source: ABS (2010) Cat No 7121.0. Note: ML for milk; n/a – not available. Sheep/beef includes wool.

5 - Share of world volume of production

With 3.4% of global production, sheep/beef is the Australian agricultural industry that is most significant internationally. The Australian horticulture industry accounts for around 0.3% of world horticultural output, which is more significant than rice, poultry or eggs, but less significant than any of the other agricultural industries (Table 4.5).

Table 4.5: Share of world output (%, 2007)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0.3	2.3	3.4	n/a	0.01	1.8	2.2	1.1	1.7	0.1	0.3	0.5

Source: FAO (2009). Note: n/a – not available.



6 - Total volume of organic production

Organic production is particularly important in the horticultural industry. A total of 15,686 tonnes of output (around 0.4% of total output) were from organic production (Table 4.6).

Table 4.6: Volume of organic production (tonnes, 2008)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
15,686	n/a	8,775	205	n/a	4,017	n/a	n/a	5,600	n/a	n/a	n/a

Source: BFA (2008). Note: ML for milk; n/a – not available. Horticulture based on vegetables, fruit and nuts only (in other cases, horticulture includes nursery/floriculture, mushrooms/vegetables, fruit and tree nuts).

Data is survey data, and is not intended to be a precise description of the current level of organic production. The extrapolated data presented are estimates and are not intended to be exact figures.

7 - Organic share of total volume of production

The share of organic production in total production is small (i.e. less than 0.5%) in all of the industries for which data are available. Horticulture is the industry with the largest proportion of organic production with 0.4% (Table 4.7).

Table 4.7: Organic share of total volume of production (%, 2008)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0.4	n/a	0.3	0.1	n/a	0.01	n/a	n/a	0.1	n/a	n/a	n/a

Source: BFA (2008); ABS (2010) Cat No 7121.0. Note: n/a – not available. Horticulture based on vegetables, fruit and nuts only (in other cases, horticulture includes nursery/floriculture, mushrooms/vegetables, fruit and tree nuts).

BFA data is survey data, and is not intended to be a precise description of the current level of organic production. The extrapolated data presented are estimates and are not intended to be exact figures.

8 - Total gross value of production (GVP)

With \$7.9 billion in gross value of production, horticulture is the third largest agricultural industry in Australia after grains (\$10.3 billion) and sheep/beef (\$10.2 billion). Horticulture is larger than wool, sugar, cotton, poultry, eggs and pigs combined (Table 4.8).

Table 4.8: Gross value of production (\$ million, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
7,894	887	10,171	1,806	36	10,295	983	685	3,988	1,862	413	895

Source: ABARE (2010)

9 - GVP generated per employee

GVP generated per employee is highest for the poultry industry (\$946,365 per employee), the rice industry (\$739,583 per employee) and the grains industry (\$568,755 per employee). Horticulture is about average with \$195,648 per employee – higher than viticulture, sheep/beef, sugar, dairy cattle and eggs (Table 4.9).



Table 4.9:	Gross value of	production	per employee (\$, 2008-09)
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Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
195,648	80,636	89,011	n/a	739,583	568,755	159,319	346,669	181,296	946,365	161,922	274,341

Source: ABARE (2010); ABS (2006) Cat No 2608.0. Note: n/a – not available. In this case, horticulture includes table and dried grapes, while viticulture excludes those (in other cases, viticulture includes table and wine grapes).

10 - GVP generated per hectare of production land used

In terms of GVP generated per hectare of production land used, the horticultural industry is the third most productive agricultural industry after poultry and eggs. Per hectare of production land, \$3,227 in gross value of production is created (Table 4.10).

Table 4.10: Gross value of production per hectare (\$, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
3,227	999	25	n/a	380	178	882	394	1,407	18,793	3,913	1,482

Source: ABARE (2010); ABS (2006) Cat No. 2068.0. Note: n/a – not available. Sheep/beef includes wool.

11 - Industry GVP as a share of total agricultural GVP

With a share of 18.7% of total agricultural GVP, the horticultural industry is the third largest industry behind grains (25.1%) and sheep/beef (24.8%). Together, those three industries account for more than two thirds (68.6%) of total agricultural production (Table 4.11).

Table 4.11: Industry % of total agricultural GVP (%, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
18.7	2.7	24.8	4.4	0.1	25.1	2.4	1.7	9.7	4.5	1.0	2.2

Source: ABARE (2010)

Employment

12 - Total employment

In 2006, a total of 226,481 people were employed in the agricultural sector. The agricultural industries used in the scorecard represent 98% of those employees.

Horticulture employs 40,348 people, which accounts for 17.8% of agricultural employment. In terms of employment, horticulture is the second largest of the agricultural industries, after sheep/beef, which employs 114,261 people (50.5% of agricultural employment) (Table 4.12 and Table 4.1).

Table 4.12: Number of employees (2006)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
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Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
40,348	11,000	114,261	n/a	48	18,101	6,170	1,975	21,995	1,967	2,550	3,262

Source: ABS (2006) Cat No 2608.0. Note: n/a – not available. Sheep/beef includes wool. ABS Census data has a high level of reliability and accuracy.



Chart 4.1: Employment shares (2006)

Source: ABS (2006) Cat No 2608.0

Within the horticultural industry, mushroom and vegetable growing farms employ the largest number of people (16,419 persons, 40.7% of horticultural employment), followed by fruit and tree nut growing farms (15,751 persons, 39.0%). The nursery and floriculture production industry employs the remaining 8,178 people (20.2%).

13 - Median weekly wages

Average wages in the horticultural industry were \$709 in median weekly earnings (before tax). This was below those in most other Australian agricultural industries such as sugar, cotton, dairy cattle, sheep and beef cattle, rice cultivation and grain growing. Only pig farming, poultry and eggs had slightly lower median earnings (Table 4.13). The median weekly earnings for the total Agriculture, Fishing and Forestry industry were \$776, compared to \$1,000 across all industries.

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
709	709	769	n/a	769	769	1,080	1,080	850	700	700	538

Table 4.13: Median weekly earnings (\$ before tax, 2008)



Source: DEEWR Skills Info (2008) based on ABS data (special request). Note: n/a – not available. Horticulture figure is based on the employment-weighted average of DEEWR industry categories (1) nursery/floriculture, (2) mushroom/vegetables and (3) fruit/tree nuts; viticulture average for industry category 'fruit/tree nuts'; sheep/beef, rice and grains are based on the average for industry category 'sheep, beef and grain growing'; sugar and cotton are based on the industry category 'other crop growing' (other than included in 'sheep, beef and grain growing'); poultry and eggs are based on industry category 'poultry'.

Trade

14 - Total wholesale trade value

Based on ABS (2008) SLA data (:), the horticultural industry is, with \$8.3 billion in gross value of production, only the third largest wholesale industry – after grains (\$14.4 billion) and sheep/beef (\$10.0 billion). The horticultural wholesale value is larger than that of viticulture, rice, sugar cane, cotton, dairy cattle, poultry, eggs and pig farming combined.

Table 4.14: Wholesale trade (based on gross value, \$ million, 2006-07)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
8,302	872	10,045	2,282	55	14,374	1,248	507	3,178	1,052	388	675

Source: ABS (2008) Cat No 7125.0. High reliance on data with RSEs between 10-50%, with some over 50%. Data should be treated with caution.

15 - Value of commodity exports (fob)

In relation to export trade, horticulture is substantially smaller than other agricultural industries (Table 4.15). With \$1.3 billion in exports in 2009, it accounts for only 5.0% of the export value of the agricultural industries included in the scorecard. Particulary fruit is being exported, with the export value for fruit amounting to \$898 million in 2008-09, while the export value of vegetables was \$397 million. Grains, sheep/beef, dairy cattle, viticulture, wool and sugar cane are all stronger performing export industries than horticulture.

Table 4.15: Export trade (\$ million, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
1,296	2,428	7,162	2,321	31	7,817	1,335	520	2,679	43	n/a	124

Source: ABARE (2009). Note: n/a – not available.

16 - Exports per employee

In per-employee terms, horticultural exports are second lowest (after poultry). With an average \$32,111 per employee, it is significantly lower than rice exports (\$653,858 per employee) and grains exports (\$431,870 per employee) (Table 4.16).

Table 4.16: Exports per employee (\$, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
32,111	220,765	62,683	n/a	653 <i>,</i> 858	431,870	216,433	263,079	121,805	21,714	n/a	37,930



Source: ABARE (2009); ABS (2006) Cat No 2608.0. Note: n/a - not available.

17 - Value of commodity imports

The Australian horticultural industry is with \$1.8 billion in imports the largest importing industry in the agricultural sector, accounting for nearly half (48.1%) of the import value of the agricultural industries included in the scorecard (Table 4.17). In 2008-09, Australia imported \$991 million worth of fruit and \$842 million worth of vegetables. Dairy (\$631 million), wine (\$502 million) and pig meat (\$500 million) are also commodities with significant import values.

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
1,833	502	19	0	211	52	26	37	631	0	n/a	500

Table 4.17: Imports (\$ million, 2008-09)

Source: ABARE (2009). Note: n/a – not available.

18 - Net trade balance

Looking at the net trade balance in different industries and the reliance on imports as measured by the industry's net exports, Australia's supply of horticultural products is more dependent on imports from other countries than any other agricultural industry (Table 4.18). Other net importing industries in the agricultural sector are rice and pig meat. Strong net exporters are grains, sheep/beef, wool and dairy.

Table 4.18: Net exports (\$ million, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
-538	1,927	7,143	2,321	-179	7,754	1,309	483	2,048	43	n/a	-376

Source: ABARE (2009). Note: n/a – not available.

On balance, Australia imported \$444 million worth of vegetables and \$93 worth of fruit, amounting to net exports of \$538 million in 2008-09. The Australian horticultural industry has traditionally been a net exporter, but imports started to exceed exports from 2003-04 (Chart 4.2). While vegetables have been a commodity with net imports for the past seven years, the Australian fruit industry has only been importing more than exporting for the past three years. However, there appears to be a trend towards rising net imports over time for both fruits and vegetables.







Source: ABARE (2009)

Growth

19 - Past GVP growth (average 2003-04 to 2008-09)

With an average annual growth rate of 7.6%, horticulture has been one of the fastest growing agricultural industries over the past five years. Only poultry (9.1% per annum) and dairy cattle (8.4% per annum) have been growing faster, while rice and wool have been in decline over that period (Table 4.19).

Table 4.19: Past GVP growth (% per annum, 2003-04 to 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
7.6	2.0	3.4	-4.9	-16.1	1.8	3.0	0.4	8.4	9.1	4.6	0.4

Source: ABARE (2010). Note: n/a – not available.

20 - GVP growth forecast (average 2008-09 to 2010-11)

ABARE (2010) provides GVP growth forecasts until 2010-11. Based on those estimates, horticulture is expected to grow an average 8.8% per annum over the next two years (from



\$7.9 billion in 2008-09 to \$8.3 billion in 2009-10 and \$9.0 billion in 2010-11). Only cotton and sugar are forecast to grow faster, while rice is expected to recover. Grains, dairy cattle, sheep/beef and poultry are expected to contract (Table 4.20).

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
8.8	1.3	´-1.7	8.2	118.8	-11.6	16.7	30.8	-9.8	-1.9	2.1	8.1

Table 4.20: GVP growth forecast (% per annum, 2008-09 to 2010-11)

Source: ABARE (2010). Note: n/a – not available.

GVP for rice dropped to \$36 million in 2008/09 (from \$284 million in 2005/06) and is forecast to recover, reaching \$120 million in 2010/11. Hence, the forecasted GVP growth of 118.8% per annum reflects a recovery of the industry rather than a strong growth trend.

Comment: International growth potential

Based on OECD-FAO estimates on longer term population and income projections, global food production needs to increase more than 40% by 2030 and 70% by 2050 compared to average 2005-07 levels (OECD, 2009), that is, an increase of around 1.6% to 1.7% per annum.

Not all of the additional demand has to come from additional farm land. Crop and livestock productivity, for instance, continues to rise at longer term trend rates (e.g. due to the development and adaptation of new technologies) and there is considereable potential for further increases over the next 10-20 years. However, a slowdown is expected in the expansion of areas under irrigation due to limited water availability and potential water stress as a result of climate change (agriculture already accounts for over 40% of water use in OECD countries and use has been growing).

Furthermore, demand may not rise equally for all products, as demand for particular commodities depends on both income and food prices. As per capita incomes grow, people tend to consume more of those agricultural commodities with high income demand elasticities such as dairy products, meat, fruits and vegetables and relatively fewer cereals and grains (although demand for grains used for animal feed tends to increase as per capita income rises). However, as per capita incomes have increased, food prices have also risen (due to new biofuel demands and record oil prices, although prices have declined more recently as a result of the financial crisis, world recession and falling oil prices). Rising food prices affect quantity and quality of consumption and spending on food in general. Among the poorest population groups, for instance, higher food prices tend to increase the per capita cereal consumption as consumers shift to a cereals-based diet away from more expensive and higher-quality food groups such as meat, dairy products, fruits and vegetables (FAO, 2009). Hence, an increase in demand for horticultural products created by an increase in per capita incomes may be partly offset by a shift in demand as a result of rising food prices.

Farm details

21 - Total number of farm businesses

In 2008-09, there were a total of 120,941 agricultural farms in Australia. Beef cattle and sheep (including wool) accounted for the largest share (58.1% of farms), followed by farms producing grains (10.8%) and horticultural farms (10.5%) (Table 4.21 and Chart 4.3).



Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
12,745	5,926	70,262	n/a	105	13,110	3,762	276	7,749	765	309	682

Table 4.21:	Number	of farm	businesses	(2008-09)
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Source: ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

There was a moderate reliance on data with RSE between 10-25%, with some up to 50%. Data should be treated with caution. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality assured. The resultant value estimates have been checked against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.



Chart 4.3: Number of farm businesses (2008-09)

Source: ABS (2010) Cat No 7121.0. Note: Sheep/beef includes wool.

The average farm in the horticultural industry is with only 192 hectares at the low end of the scale (Table 4.22). This compares with around 6,300 for cotton farms and over 5,700 hectares for sheep/beef farms. Horticultural farms also tend to be smaller than farms growing rice, grains or sugar cane, only poultry farms and vineyards are smaller.

22 - Average number of employees per farm business

The horticultural industry is about average in terms of labour intensity per farm (Table 4.22). On average, 2.6 people are employed on a horticultural farm, compared with up to 5.4 in egg producing farms and only 1.4 people for sheep and beef cattle farms. Rice cultivation employs less than one Full Time Equivalent (FTE) per farm (48 employees on 101 farms).



Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
2.6	1.6	1.4	n/a	0.5	1.5	1.5	2.9	2.3	2.3	5.4	3.6

Table 4.22: Average number of employees per farm business (2006)

Source: ABS (2006) Cat No 2608.0; ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

23 - Average land area per farm

Table 4.23: Average farm size (hectares, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
192	150	5,780	n/a	891	4,401	296	6,300	366	129	341	885

Source: ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

The above three parameters have all experienced significant change from their 2005-2006 levels to their 2008-2009 levels. As can be seen in Table 4.24 below, the number of farms has dropped dramatically across almost all industries. This coincides with a reduction in the total land area of production in most industries and an increase in average farm size across all industries but rice. It is likely that this trend is a result of the 2006 drought.

These numbers would suggest that farms have gone out of business across almost all agricultural industries in recent years. However, there has also been a consolidation of farming enterprises, leading to an increase in average farm size. The one big loser over this period of time has been the rice industry, which has seen huge reductions in the number of farms (-86.7%), total area of production (-94.0%) and average farm size (-54.9%). Cotton also experienced significant decreases its number of farms (-59.8%) and area of production (-52.3%). This is confirmation that these industries are particularly susceptible to the negative effects of drought.

	Horticulture	Viticulture	Sheep/ beef	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig			
					Number o	of farms								
2005-2006	15,431	6,692	79,574	787	12,478	4,207	687	9,371	860	468	914			
Change (%)	-17.4	-11.5	-11.7	-86.7	5.1	-10.6	-59.8	-17.3	-11.1	-34.0	-25.4			
		Total land area of production ('000 hectares)												
2005-2006	2,628	773	441,653	1,554	50,471	1,244	3,642	3,123	94	116	626			
Change (%)	-6.9	14.9	-8.2	-94.0	14.3	-10.5	-52.3	-9.2	5.8	-9.1	-3.6			
				Avera	age farm si	ize (hecta	ires)							
2005-2006	170	115	5,550	1,975	4,045	296	5,302	333	109	248	685			
Change (%)	12.7	29.7	4.1	-54.9	8.8	0.1	18.8	9.8	18.9	37.6	29.3			

Table 4.24: Changes in average farm characteristics from 2005-2006 to 2008-2009

Source: ABS (2010 and 2008) Cat No 7121.0. Note: sheep/beef includes wool.



24 - Average GVP per farm business

On a per farm level, gross value of production is highest for cotton, poultry, egg and pig producing farms. Horticultural farms produce output worth an average of \$619,000 per farm, which is higher than the per-farm GVP for viticulture, sheep/beef, rice, sugar and dairy cattle farmers (Table 4.25).

Table 4.25:	Average GVP	per farm	business	(\$'000,	2008-09)
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Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
619	150	145	n/a	338	785	261	2,481	515	2,433	1,336	1,312

Source: ABARE (2010); ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

25 - Farm business profit (average 2005-06 to 2007-08)

With an average of \$67,741 in farm profits per farm per annum between 2005-06 and 2007-08, horticulture is more profitable than sheep/beef, grains and dairy cattle (Table 4.26).

Table 4.26: Farm business profit (\$ per annum, 2005-06 to 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
67,741	n/a	1,189	n/a	n/a	-27,663	n/a	n/a	9,490	n/a	n/a	n/a

Source: ABARE (2009). Note: n/a – not available. Horticulture includes vegetables only. Sheep/beef includes wool.

Estimates from all industries except horticulture are final estimates which means all data from farmers have been reconciled, final production and population information from the ABS has been included and no further change is expected in the estimates. Horticulture estimate had an RSE of 17%. Note: Farm business profit = farm cash income + changes in trading stocks - depreciation - imputed labour costs)

26 - Average rate of return (average 2005-06 to 2007-08)

With an average annual rate of return of 3.6% between 2005-06 and 2007-08, horticulture has been more profitable than sheep/beef, grains and dairy cattle (Table 4.27).

According to the ABARE Farm Survey Results, rates of return excluding capital appreciation have been adversely affected in many regions by poor profit results as a result of adverse seasonal conditions. Rises in total farm capital values as a consequence of increases in land values have also reduced rates of return excluding capital appreciation.

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
3.6	n/a	0.7	n/a	n/a	0.7	n/a	n/a	1.7	n/a	n/a	n/a

Table 4.27: Average rate of return (%, 2005-06 to 2007-08)

Source: ABARE (2009). Note: n/a - not available. Horticulture includes vegetables only. Sheep/beef includes wool.

Estimates from all industries except horticulture are final estimates which means all data from farmers have been reconciled, final production and population information from the ABS has been included and no further change is expected in the estimates. Horticulture estimate had an RSE of 13%. Note: rate of return = profit at full equity (excl capital appreciation) as a percentage of total opening capital.



27 - Net capital additions, average per farm

Net capital additions in the horticultural industry were with \$49,800 per farm per annum about average for agricultural industries. The grains industry had higher average net capital additions, while sheep/beef was significantly lower (Table 4.28).

Table 4.28: Net capital additions, average per farm (\$ per annum, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
49,800	n/a	16,707	n/a	n/a	108,830	n/a	n/a	74,150	n/a	n/a	n/a

Source: ABARE (2009). Note: n/a – not available. Horticulture includes vegetables only. Sheep/beef includes wool.

28 - Net capital additions, industry total

In terms of industry total, net capital additions are largest for grains and sheep/beef. With \$635 million, horticulture is similar to dairy cattle and thus on the lower side (Table 4.29).

Table 4.29: Net capital additions, industry total (\$ million per annum, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
635	n/a	1,174	n/a	n/a	1,427	n/a	n/a	575	n/a	n/a	n/a

Source: ABARE (2009); ABS (2010) Cat No 7121.0. Note: n/a – not available. Horticulture includes vegetables only. Sheep/beef includes wool.

29 - GVP generated per \$ of net capital additions

Looking at GVP generated per dollar invested, horticulture (with \$12.4 generated per dollar of net capital additions) proves to be the most productive industry – ahead of sheep/beef, grains and dairy cattle (Table 4.30).

Table 4.30: GVP generated per \$ of net capital additions (\$ per annum, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
12.4	n/a	8.7	n/a	n/a	7.2	n/a	n/a	6.9	n/a	n/a	n/a

Source: ABARE (2009); ABARE (2010). Note: n/a – not available. Horticulture includes vegetables only. Sheep/beef includes wool.

30 - Total business expenditure on R&D

The horticultural industry devotes the largest amount of funds (\$9,022,000) to innovation and research. This is \$468,000 more than is invested by the grains industry and \$787,600 more than is invested by the viticulture industry (Table 4.31 and Chart 4.4).

Table 4.31: R&D expenditure (\$ 000s, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
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culture o	culture	beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
9,022	1,146	n/a	n/a	n/a	8,554	n/a	n/a	n/a	n/a	n/a	n/a

Source: ABS (2009) Cat No 8104.0. Note: n/a – not available.

The ABS made every effort to minimise non-sampling error by careful design and testing of the collection instrument, use of efficient operating procedures and systems, and use of appropriate methodologies. In 2007-08, the Survey of R&D for the Business sector achieved a 92% response rate.



Chart 4.4: \$000s Spent on Innovation/Research (2007-08)

Source: ABS (2009) Cat No 8104.0

31 - Total business expenditure on R&D per GVP generated

With \$1,154 in R&D expenditure for every \$ million of GVP generated, horticulture is more R&D intensive than viticulture or grains (Table 4.32).

Table 4.32: Total business expenditure on R&D per \$ million of GVP generated (\$, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
1,154	696	n/a	n/a	n/a	811	n/a	n/a	n/a	n/a	n/a	n/a

Source: ABS (2009) Cat No 8104.0; ABARE (2010). Note: n/a – not available.

The ABS made every effort to minimise non-sampling error by careful design and testing of the collection instrument, use of efficient operating procedures and systems, and use of appropriate methodologies. In 2007-08, the Survey of R&D for the Business sector achieved a 92% response rate.

32 - Average expenditure on R&D per farm business

With \$708 per farm, horticulture also has a higher R&D expenditure on a per farm basis than viticulture and grains (Table 4.33).



Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
708	193	n/a	n/a	n/a	652	n/a	n/a	n/a	n/a	n/a	n/a

Table 4.33: Average expenditure on R&D per farm business (\$, 2007-08)

Source: ABS (2009) Cat No 8104.0; ABS (2010) Cat No 7121.0. Note: n/a – not available.

The ABS made every effort to minimise non-sampling error by careful design and testing of the collection instrument, use of efficient operating procedures and systems, and use of appropriate methodologies. In 2007-08, the Survey of R&D for the Business sector achieved a 92% response rate.

4.1.2 Environmental parameters

Greenhouse gas emissions

Total greenhouse gas emissions in agriculture are split into six categories: enteric fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savannas and field burning of agricultural residues. The National Greenhouse Gas Inventory provided industry detail on emissions for some of the emissions categories, but not all (as outlined in Table 4.34). No industry detail was available for agricultural soils (which accounts for 17% of CO₂ emissions in agriculture). However, no methane emissions are associated with agricultural soils. Hence, details on methane emissions are sufficient to link emissions and industries.

Table 4.34: Agricultural greenhouse gas emissions – Industry concordance

		Contributing industries	Industry detail available?
Enteric fermentation	CH_4	Sheep/beef, dairy cattle, poultry, pigs, other livestock	Yes.
	N_2O		
Manure management	CH_4	Sheep/beef, dairy cattle, poultry, pigs, other livestock	Yes.
	N ₂ O	Anaerobic lagoons and Solid storage and dry lot: all livestock	Anaerobic lagoons and Solid storage and dry lot: No. % based on production volume.
		Other animal waste management systems : poultry	Other animal waste management systems: yes.
Rice cultivation	CH_4	Rice	Yes.
	N ₂ O		
Agricultural soils	CH_4		
(direct emissions, indirect emissions, pasture)	N ₂ O	All HAL categories: horticulture, viticulture,	Agricultural soil (livestock) based on DCC data.
		sheep/beef, wool, rice, grains, sugar, cotton, dairy cattle, poultry, eggs, pigs, other livestock.	Remainder based on % of fertiliser use (as per DCC statistics) assuming equal emissions factors.
Prescribed burning of savannas	CH_4	Sheep/beef	No. All assumed to relate to sheep/beef.
	N_2O	Sheep/beef	No. All assumed to relate to

			sheep/beef
Field burning of agricultural	CH_4	Crops, sugar cane	Yes.
residues	N_2O	Crops, sugar cane	Yes.

34 - Total methane (CH₄) emissions

With 56.7 Mt of CH_4 , the sheep/beef industry accounts for 85% of Australia's agricultural methane emissions. Dairy cattle contributed another 10%, while industries such as horticulture, viticulture and cotton do not have any methane emissions (Table 4.35).

Table 4.35: Methane emissions (Mt CO₂-e, 2008)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0	n/a	56,742	n/a	43	161	25	0	6,710	49	n/a	1,251

Source: DCC (2010); National Greenhouse Gas Inventory, Common Reporting Format Table 'Agriculture'. Note: n/a - not available. Emissions factor used to convert CH_4 into CO_2 equivalent was 21; greenhouse gas accounting follows Kyoto Protocol. Horticulture includes viticulture; sheep/beef includes wool; poultry includes eggs. Sheep/beef methane emissions include 9,549 tonnes of CO_2 equivalent from prescribed burning of savannas.

35 - Total nitrous oxide (N₂O) emissions (approximations)

Sheep/beef cattle farms also account for the largest share of nitrous oxide emissions (12.4 Mt of CO_2 -e or 61.6%) (Table 4.36). Without inclusion of 'burning of savannas' into the sheep/beef category, the share would still be 44.4% (8.9 Mt of CO_2 -e). In comparison, horticulture is a very small emitter of nitrous oxide, with 0.6 Mt of CO_2 -e (3.2% of agricultural nitrous oxide emissions) caused by the use of fertiliser.

Table 4.36: Nitrous oxide emissions (Mt CO₂-e, 2007)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0.6	n/a	12.4	n/a	0.0	1.7	0.7	0.4	3.2	0.9	n/a	0.2

Source: National Greenhouse Gas Inventory (NGGI) Common Reporting Format Table 'Agriculture'; NGGI Activity Table 'Fertiliser', DCC data request (estimates on agricultural soil emissions for livestock). Note: n/a – not available. Emissions factor used: 310

36 – Average greenhouse gas (CO₂-e) emissions per tonne of output

On a per volume basis, horticulture is also a small emitter with only 0.2 kg of CO_2 -e per tonne of output (Table 4.37). Only sugar cane and grains have lower emissions per tonne of output. In contrast, the sheep/beef industry is responsible for 27.2 kg of CO_2 -e per tonne of meat.

Table 4.37: Average greenhouse gas emissions (kg CO₂-e per tonne of output, 2007)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0.2	n/a	27.2	n/a	0.7	0.1	0.0	1.3	1.0	1.2	n/a	4.4

Source: ABARE (2010); ABS (2009) Cat No 7121.0; ABS (2009) Cat No 7215.0; National Greenhouse Gas Inventory (NGGI) Common Reporting Format Table 'Agriculture'; NGGI Activity Table 'Fertiliser', DCC data request (estimates on agricultural soil emissions for livestock). Note: n/a – not available.



37 – Total greenhouse gas (CO₂-e) emission per GVP generated

Relative to GVP generated, total greenhouse gas emissions are highest for sheep/beef and dairy cattle. Horticulture is the lowest greenhouse gas emitter relative to GVP generated with 0.1 tonne of CO_2 -e emitted per \$1 million GVP generated per year (Table 4.38). Grains, sugar, poultry and cotton are also low emitters.

Table 4.38: Total greenhouse gas (CO2-e) emission per GVP generated (tonnes of
CO2-e/\$ million per year)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0.1	n/a	5.8	n/a	1.2	0.2	0.7	0.6	2.5	0.4	n/a	1.6

Source: ABS (2009) Cat No 7121.0; ABS (2009) Cat No 7215.0; National Greenhouse Gas Inventory (NGGI) Common Reporting Format Table 'Agriculture'; NGGI Activity Table 'Fertiliser', DCC data request (estimates on agricultural soil emissions for livestock). Note: n/a – not available.

38 - Total methane (CH₄) emissions per GVP

Relative to GVP generated, methane emissions are highest for sheep/beef, dairy cattle, pig and rice, while horticulture, viticulture and cotton do not have any methane emissions (Table 4.39).

Table 4.39: Total methane emissions per GVP generated (Mt CO₂-e, 2008)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
0	n/a	4.7	n/a	1.2	0.02	0.03	0	1.7	0.02	n/a	1.4

Source: ABARE (2010); DCC (2010); National Greenhouse Gas Inventory, Common Reporting Format Table 'Agriculture'. Note: n/a – not available. Emissions factor used to convert CH₄ into CO₂ equivalent was 21; greenhouse gas accounting follows Kyoto Protocol. Horticulture includes viticulture; sheep/beef includes wool; poultry includes eggs. Sheep/beef methane emissions include 9,549 tonnes of CO₂ equivalent from prescribed burning of savannas.

Resource use

40 - Total water use

The horticulture sector uses 1,083,141 megalitres of water per year. This is the second highest amount, after the sheep/beef sector, which uses 1,336,980 megalitres of water per year. The horticulture sector uses 293, 214 more megalitres of water per year than the average across the sectors, which is 789,927 megalitres (Table 4.40 and Chart 4.5).

Table 4.40: Total water use ('000 ML, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
1,083	543	1,337	n/a	101	824	761	880	1,337	n/a	n/a	n/a

ABS Cat No (2010) Cat No 4618.0. Note: n/a – not available.

Rice estimates had a RSE from 10-25% and should be treated with caution. Other estimates had RSEs less than 10%. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality



assured. The resultant value estimates have been checked against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.



Chart 4.5: Total Water Used

41 - Average water use per hectare

On a per hectare basis, the horticultural industry's per hectare water usage is 4.6 ML. This is lower than rice (14.1 ML per hectare) and cotton (6.2 ML per hectare), but more intensive than other forms of Australian agriculture, which range from 2.8 ML per hectare (grains) to 4.0 ML per hectare (sugar cane) in water use (Table 4.41).

Table 4.41: Average water use (ML per hectare, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
4.6	3.2	3.2	n/a	14.1	2.8	4.0	6.2	3.2	n/a	n/a	n/a

Source: ABS Cat No (2010) Cat No 4618.0. Note: n/a – not available.

All estimates have RSEs less than 10%. Data from the 2008-09 Agricultural Survey are based on a response rate of 88% and has been extensively quality assured. The resultant value estimates have been checked against earlier years and relevant other sources, including contact with data providers, to ensure the accuracy of the estimates produced.

42 - Average water use per GVP generated

Relative to gross value of production generated, rice and cotton are the most water intensive industries. Horticulture uses 137 litres of water per dollar of GVP generated, which is only slightly higher than sheep/beef (131 litres) and grains (80 litres) (Table 4.42).

Table 4.42: Average water use per GVP generated (ML/\$million, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
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Source: ABS Cat No (2010) Cat No 4618.0

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
137	612	131	n/a	2,858	80	774	1,285	335	n/a	n/a	n/a

Source: ABS Cat No (2010) Cat No 4618.0. Note: n/a – not available. Sheep/beef includes wool.

43 - Average hectares of production land used per GVP generated

Rice and cotton are not only water intensive, but also land intensive agricultural industries, although the sheep/beef industry uses by far the most production land per GVP generated (39,931 hectares per \$ million in GVP). Horticulture only uses 310 hectares for each \$ million in GVP generated. The only industries that are even less land intensive are poultry and eggs (Table 4.43).

Table 4.43: Production land used per GVP generated (hectares/\$ million, 2008-09)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
310	1,001	39,931	n/a	2,635	5,604	1,133	2,540	711	53	256	675

Source: ABARE (2010); ABS (2010) Cat No 7121.0. Note: n/a – not available. Sheep/beef includes wool.

4.1.3 Social parameters

Location

44 - Main production state based on % of industry GVP

There are many dimensions to the idea of main growing states, in addition to the headline results presented in the Scorecard and in Table 4.44 below. This set of figures indicates the state that is home to the highest proportion of each agricultural industry and what that proportion is. There are only four states in which feature on this list – Queensland, South Australia, New South Wales and Victoria. South Australia only makes the cut for viticulture, producing almost half of Australia's viticulture value, while the other three states appear several times. The proportion of the industry in its main growing state is an indication of how dispersed production is across Australia. For example, approximately 99% of Australian rice is grown in New South Wales, indicating that this industry is heavily concentrated here. At the other end of the scale, 23% of grains are grown in Queensland, indicating that grain production is more evenly spread across the nation. Approximately 33% of horticulture is produced in Queensland, indicating a reasonably even spread across states.

It is important to note, that when making the calculations for this parameter, there was no data available on the value of poultry and pig production in South Australia, Western Australia or Tasmania.



Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
QLD	SA	QLD	NSW	NSW	QLD	QLD	NSW	VIC	NSW	VIC	NSW
(33.1)	(49.0)	(38.4)	(32.1)	(98.6)	(22.9)	(91.6)	(76.1)	(63.5)	(40.7)	(27.5)	(43.8)

Table 4.44:	Main growing States	(proportion of	value produced in	n that state)
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Source: ABS (2008) Cat No 7125.0. Note: High standard errors apply to rice, eggs for SA and WA, horticulture in the ACT. In the case of poultry and pig no data were available for production in South Australia, Western Australia and Tasmania.

Chart 4.6 and Chart 4.7 show the distribution of horticulture across states and the distribution of total agriculture across states, respectively. As mentioned above, Queensland produces the highest proportion of horticulture value in Australia, at 33%. This is followed closely by Victoria (26%), with New South Wales (17%) and South Australia (11%) a bit further behind.

When looking at the distribution of total agriculture (rather than at industry level) across states, the result is close to that of the main growing states. Queensland, Victoria and New South Wales still feature in the top three. However, Western Australia comes in fourth, rather than South Australia. The edge that South Australia's viticulture industry gave it at industry level dissipates when looking at agriculture in aggregate.



Chart 4.6: Percentage of horticulture in each state



Source: ABS (2008) Cat No 7125.0



Chart 4.7: Distribution of total agricultural production across states

Chart 4.8 through Chart 4.12 give a more detailed look at the main growing states identified in Chart 4.7. They show the proportion of each industry over total agricultural value in that state. There are some interesting results here. For example, even though 99% of Australia's rice is produced in NSW, it contributes only 1% to the total value of NSW's agricultural produce (Chart 4.8). Similarly, while Queensland is the main growing state for horticulture, grains and sheep/beef, both contribute a higher proportion of its total agricultural value (Chart 4.10). Victoria is the main production state for dairy cattle and eggs, but grains, horticulture and sheep/beef all contribute a higher proportion of total agricultural value here (Chart 4.9). Finally, even though almost half of Australia's viticulture value of production is located in South Australia, viticulture makes up only 9% of the state's total agricultural value (Chart 4.11).



Source: ABS (2008) Cat No 7125.0



Chart 4.8: Gross value of production by industry, New South Wales



Chart 4.9: Gross value of production by industry, Victoria

Source: ABS (2008) Cat No 7125.0



Source: ABS (2008) Cat No 7125.0





Source: ABS (2008) Cat No 7125.0











Source: ABS (2008) Cat No 7125.0



45 - Urban production

Table 4.45 indicates the proportion of the value of each industry located in urban natural resource management (NRM) regions. These are generally the NRM regions of each State encompassing its capital city and surrounding areas. The NT and ACT each have only one NRM region covering their entire Territory. For the NT this was not considered to be urban. The reverse is true of the ACT. As these NRM regions encompass the areas *surrounding* Australia's major cities, they capture some agricultural production that takes place on the urban fringe. Hence, the production of poultry, eggs and horticulture can be seen as having a high level of proximity to population centres. Whereas rice and cotton are agricultural activities that take place remotely from major population centres.

Table 4.45: Urban and surrounds vs. rural (% of value produced in urban NRM regions)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
26.4	11.6	4.2	3.2	0.0	16.6	1.1	0.0	6.6	43.5	27.5	4.3

Source: ABS (2008) Cat No 7125.0. Note: High reliance on estimates with a high standard error for urban production. In the case of poultry and pig no data were available for production in South Australia, Western Australia and Tasmania.

46 – Value of GVP generated in urban areas

Converting the percentage of urban production into GVP shows that horticulture is the agricultural industry with the largest GVP generated in urban areas. With \$2.1 billion produced in urban areas, its urban output is larger than that for grains (\$1.7 billion) and poultry (\$0.8 billion) (Table 4.46).

Table 4.46: GVP generated in urban areas (\$ million, 2006-07)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
2,084	103	430	58	0	1,713	10	0	264	810	114	38

Source: ABARE (2010); ABS (2008) Cat No 7125.0. Note: High reliance on estimates with a high standard error for urban production.

Other social parameters

47 - Demographic profile of employees

The median age for farmers in the horticultural industry is with 44.5 years about average for the agricultural sector (Table 4.47). Beef/sheep and wool farmers as well as rice and grain growers tend to be slightly older, while poultry and egg farmers tend to be younger.

Table 4.47:	Median	age of farmers	(2009)
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Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
44.5	44.5	51.0	51.0	51.0	51.0	37.3	47.3	45.0	37.0	37.0	42.8

Source: DEEWR Skills Info (2009) based on ABS data (special request). Horticulture figure is based on the employment-weighted average of DEEWR industry categories (1) nursery/floriculture, (2) mushroom/vegetables



and (3) fruit/tree nuts; viticulture average for industry category 'fruit/tree nuts'; sheep/beef, rice and grains are based on the average for industry category 'sheep, beef and grain growing'; sugar and cotton are based on the industry category 'other crop growing' (other than included in 'sheep, beef and grain growing'); poultry and eggs are based on industry category 'poultry'.

48 - Farm use of internet

With 65.4% of horticultural farms using the internet, internet use in the horticultural industry is on the low end of the scale (Table 4.48). Pig farmers along with sugar and cotton growers have the highest rate of internet access.

Table 4.48: Internet use (% of farms, 2007-08)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
65.4	65.4	65.0	n/a	65.0	65.0	71.0	71.0	66.0	69.0	69.0	73.0

Source: ABS (2009) Cat No 8150.0. Note: Horticulture figure is based on the employment-weighted average of DEEWR industry categories (1) nursery/floriculture, (2) mushroom/vegetables and (3) fruit/tree nuts; viticulture average for industry category 'fruit/tree nuts'; sheep/beef, rice and grains are based on the average for industry category 'sheep, beef and grain growing'; sugar and cotton are based on the industry category 'other crop growing' (other than included in 'sheep, beef and grain growing'); poultry and eggs are based on industry category 'poultry'.

49 - Percentage female to male employees

The share of female employees is highest in poultry and egg producing farms and lowest in viticulture, sugar and cotton. With 33.6%, the female share is about average for horticulture (Table 4.49).

Table 4.49: Percentage female to male employees (% female, 2010)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
33.6	28.3	31.3	31.3	31.3	31.3	28.9	28.9	31.3	40.0	40.0	37.9

Source: DEEWR Skills Info (2010). Note: Horticulture figure is based on the employment-weighted average of DEEWR industry categories (1) nursery/floriculture, (2) mushroom/vegetables and (3) fruit/tree nuts; viticulture average for industry category 'fruit/tree nuts'; sheep/beef, rice and grains are based on the average for industry category 'sheep, beef and grain growing'; sugar and cotton are based on the industry category 'other crop growing' (other than included in 'sheep, beef and grain growing'); poultry and eggs are based on industry category 'poultry'.

50 - Full-time versus part-time/casual/seasonal employment

The use of part-time, casual and seasonal employees is most common in horticulture where only 69.7% of employees are full-time employees. With 75.1%, the share of full-time employees is highest for sheep/beef, wool, rice and grains (Table 4.50).

Table 4.50: Fulltime share of all employment (2010)

Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig
69.7	69.8	75.1	75.1	75.1	75.1	73.5	73.5	71.1	69.8	69.8	72.4

Source: DEEWR Skills Info (2010). Note: Horticulture figure is based on the employment-weighted average of DEEWR industry categories (1) nursery/floriculture, (2) mushroom/vegetables and (3) fruit/tree nuts; viticulture average for industry category 'fruit/tree nuts'; sheep/beef, rice and grains are based on the average for industry



category 'sheep, beef and grain growing'; sugar and cotton are based on the industry category 'other crop growing' (other than included in 'sheep, beef and grain growing'); poultry and eggs are based on industry category 'poultry'.



4.2 Balanced scorecard

	Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig	Year	Data source
Economic parameters	-													
Production														
Total area of production ('000 ha)	2,446	888	406	n/a	94	58	1,114	1,739	2,834	99	106	604	2008-09	ABS
Total volume of production ('000														
tonnes)	3,508	113	2,543	371	61	36	32	309	9,671	833	162	324	2008-09	ABS
Total volume of production, average														
2006-07 to 2008-09 ('000 tonnes)	3,537	n/a	1,661	n/a	n/a	27,290	33,492	237	n/a	331	n/a	384	2008-09	ABS
Average volume of production														
(tonnes/ha)	1.4	0.1	0.01	n/a	0.7	0.6	28.2	0.2	3.4	8.4	n/a	0.5	2008-09	ABS
Share of world output (%)	0.3	2.3	3.4	n/a	0.01	1.8	2.2	1.1	1.7	0.1	0.3	0.5	2007	FAO
Total volume of organic production														
('000 tonnes)	15.7	n/a	8.8	205	n/a	4.0	n/a	n/a	5.6	n/a	n/a	n/a	2008	BFA
Organic share of total volume of														
production (%)	0.4	n/a	0.3	0.1	n/a	0.01	n/a	n/a	0.1	n/a	n/a	n/a	2008	BFA
Total gross value of production (\$														
million)	7,894	887	10,171	1,806	36	10,295	983	685	3,988	1,862	413	895	2008-09	ABARE
GVP per employee ('000 \$/employee)	196	81	89	n/a	740	569	159	347	181	946	162	274	2008-09	ABARE
GVP generated per hectare of														
production land used (\$/hectare)	3,227	999	25	n/a	380	178	882	394	1,407	18,793	3,913	1,482	2008-09	ABARE
Industry GVP as % of total agricultural														
GVP	18.7	2.7	24.8	4.4	0.1	25.1	2.4	1.7	9.7	4.5	1.0	2.2	2008-09	ABARE
Employment														
Total employment	40,348	11,000	114,261	n/a	48	18,101	6,170	1,975	21,995	1,967	2,550	3,262	2006	ABS
Median weekly wages (\$)	709	750	769	n/a	769	769	1,080	1,080	850	700	700	538	2008	DEEWR

Table 4.51: Balanced scorecard



	Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig	Year	Data source
Trade														
Total wholesale trade (\$ million)	8,302	872	10,045	2,282	55	14,374	1,248	507	3,178	1,052	388	675	2006-07	ABS
Value of commodity exports (\$														
million)	1,296	2,428	7,162	2,321	31	7,817	1,335	520	2,679	43	n/a	124	2008-09	ABARE
Exports per employee ('000 \$)	32	221	63	n/a	654	432	216	263	122	22	n/a	38	2008-09	ABARE
Value of commodity imports (\$														
million)	1,833	502	19	0	211	52	26	37	631	0	n/a	500	2008-09	ABARE
Net trade balance (\$ million)	-538	1927	7143	2321	-179	7754	1309	483	2048	43	n/a	-376	2008-09	ABARE
Growth	_													
Past GVP growth (% per annum,														
2003-04 to 2008-09)	7.6	2.0	3.4	-4.9	-16.1	1.8	3.0	0.4	8.4	9.1	4.6	0.4	2008-09	ABARE
GVP growth forecast (% per annum,														
2008-09 to 2010-11)	8.8	1.3	-1.7	8.2	118.8	-11.6	16.7	30.8	-9.8	-1.9	2.1	8.1	2008-09	ABARE
Farm details														
Total number of farm businesses	12,745	5,926	70,262	n/a	105	13,110	3,762	276	7,749	765	309	682	2008-09	ABS
Average number of employees per														
farm business	2.6	1.6	1.4	n/a	0.5	1.5	1.5	2.9	2.3	2.3	5.4	3.6	2005-06	ABS
Average land area per farm business														
(ha)	192	150	5,780	n/a	891	4,401	296	6,300	366	129	341	885	2008-09	ABS
Average GVP per farm business ('000														
\$)	619	150	145	n/a	338	785	261	2,481	515	2,433	1,336	1,312	2007-08	ABS
Farm business profit (\$ p.a.)	67,741	n/a	1,189	n/a	n/a	-27.663	n/a	n/a	9,490	n/a	n/a	n/a	2007-08	ABARE
Average rate of return (exc capital														
appreciation) (%)	3.6	n/a	0.7	n/a	n/a	0.7	n/a	n/a	1.7	n/a	n/a	n/a	2007-08	ABARE
Net capital additions, average per														
farm (\$ per annum)	49,800	n/a	16,707	n/a	n/a	108,830	n/a	n/a	74,150	n/a	n/a	n/a	2007-08	ABARE
Net capital additions, industry total (\$														
million per annum)	635	n/a	1,174	n/a	n/a	1,427	n/a	n/a	575	n/a	n/a	n/a	2007-08	ABARE
GVP generated per \$ of net capital														
additions (\$ per annum)	12.4	n/a	8.7	n/a	n/a	7.2	n/a	n/a	6.9	n/a	n/a	n/a	2007-08	ABARE
Total business expenditure on R&D			,											
(\$'000s)	9,022	1,146	n/a	n/a	n/a	8,554	n/a	n/a	n/a	n/a	n/a	n/a	2007-08	ABS
I otal business expenditure on R&D			,	,	,		,	,	,	,	,			
per GVP generated (\$/\$ million)	1,154	696	n/a	n/a	n/a	811	n/a	n/a	n/a	n/a	n/a	n/a	2007-08	ABS



Average expenditure on R&D per														
farm business (\$)	708	193	n/a	n/a	n/a	652	n/a	n/a	n/a	n/a	n/a	n/a	2007-08	ABS
	Horti- culture	Viti- culture	Sheep/ beef	Wool	Rice	Grains	Sugar	Cotton	Dairy Cattle	Poultry	Eggs	Pig	Year	Data source
Environmental parameters														
Greenhouse gas emissions														
Total methane (CH4) and nitrous														
oxide (N20) emissions														
(approximations) (tonnes CO ₂ -e per														
year)	639.0	n/a	69.153	n/a	43	1,813	720	416	9,920	993	n/a	1,440	2007	DCC
Total methane emissions (tonnes														
CO ₂ -e per year)	0	n/a	56,742	n/a	43	161	25	0	6,710	49	n/a	1,251	2008	DCC
Total nitrous oxide (N ₂ 0) emissions														
(approximations) (tonnes CO ₂ -e per														
year)	639.0	n/a	12,411	n/a	0.0	1,652	695	416	3,211	944	n/a	190	2007	DCC
Average greenhouse gas (CO ₂ -e)														
emissions per tonne of output (kg of														
CO_2 -e/tonne per year)	0.2	n/a	27.2	n/a	0.7	0.1	0.0	1.3	1.0	1.2	n/a	4.4	2007	DCC
Total greenhouse gas (CO ₂ -e)														
emissions per GVP generated (tonnes														
CO_2 -e per year /\$million per year)	0.1	n/a	5.8	n/a	1.2	0.2	0.7	0.6	2.5	0.4	n/a	1.6	2007	DCC
Total methane emissions per GVP														
generated (tonnes CO ₂ -e per year														
/\$million per year)	0	n/a	4.7	n/a	1.2	0.02	0.03	0	1.7	0,02	n/a	1.4	2008	DCC
Total nitrous oxide (N ₂ 0) emissions														
(approximations) per GVP generated														
(tonnes CO ₂ -e per year /\$million per														
year)	0.1	n/a	1.0	n/a	0.0	0.2	0.7	0.6	0.8	0.4	n/a	0.2	2007	DCC
Resource use														
Total water use ('000 ML)	1,083	543	1,337	n/a	1025	824	761	880	1,337	n/a	n/a	n/a	2008-09	ABS
Average water use (ML per hectare)	4.6	3.2	3.2	n/a	14.1	2.8	4.0	6.2	3.2	n/a	n/a	n/a	2008-09	ABS
Average water use per GVP														
generated (ML/\$million)	137	612	131	n/a	2,858	80	774	1,285	335	n/a	n/a	n/a	2008-09	ABS
Average hectares of production land														
used per GVP generated (hectares/\$														
million)	310	1,001	39,931	n/a	2,635	5,604	1,133	2,540	711	53	256	675	2008-09	ABS



Social parameters

Location														
Main production state based on % of	QLD	SA	QLD	NSW	NSW	QLD	QLD	NSW	VIC	NSW	VIC	NSW		
industry GVP	(33.1)	(49.0)	(38.4)	(32.1)	(98.6)	(22.9)	(91.6)	(76.1)	(63.5)	(40.7)	(27.5)	(43.8)	2006-07	ABS
Urban production (% of GVP in urban														
areas and surrounds)	26.4	11.6	4.2	3.2	0.0	16.6	1.1	0.0	6.6	43.5	27.5	4.3	2006-07	ABS
Value of GVP generated in urban														
areas (\$ million)	2,084	103	430	58	0	1,713	10	0	264	810	114	38	2006-07	ABS
Other social parameters														
Demographic profile of farmers														
(median age)	44.5	44.5	51.0	51.0	51.0	51.0	47.3	47.3	45.0	37.0	37.0	42.8	2009	DEEWR
Farm use of internet (%)	65.4	65.4	65.0	n/a	65.0	65.0	71.0	71.0	66.0	69.0	69.0	73.0	2007-08	ABS
Percentage female to male														
employees (% female)	33.6	28.3	31.3	31.3	31.3	31.3	28.9	28.9	31.3	40.0	40.0	37.9	2010	DEEWR
Full-time versus part-time/casual/														
seasonal employment (% share of														
total employment that is full-time)	69.7	69.8	75.1	75.1	75.1	75.1	73.5	73.5	71.1	69.8	69.8	72.4	2010	DEEWR



4.3 Key findings

The parameters in the balanced scorecard provide a comprehensive picture of the Australian horticultural industry across economic, social and environmental dimensions. It becomes clear that the horticultural industry has a number of strengths and weaknesses when compared with other agricultural industries.

Key strengths include:

- Most profitable industry (\$74,889 in farm business profits per annum and a 4.0% rate of return).
- Largest amount of funds (\$9.0 million) to innovation and research.
- Second largest employer (40,348 employees) after sheep/beef (114,261).
- Second largest wholesale trade value (\$11.7 billion) comparable with sheep/beef (\$11.8 billion).
- Low greenhouse gas emissions (0 Mt CO2-e in methane).
- Low fuel use (4.6 litres per tonne of output).
- Significant share of organic production (0.4% of output).
- Third highest level of proximity to population centres (26% urban and surrounds) after poultry (44%) and eggs (28%).
- Largest GVP generated in urban areas (\$2.1 billion).
- Third largest industry in terms of gross value of production (\$7.5 billion) after grains (\$9.8 billion) and sheep/beef \$9.5 billion).
- Fourth most efficient land use (1.43 tonnes of output per hectare) after sugar (28.2 tonnes per hectare), poultry (8.4) and dairy cattle (3.41)
- Third most efficient land use in terms of hectares of production land used per GVP generated (310 hectares per \$ million) after eggs (256) and poultry (53).
- Second lowest water use per GVP generated (137 litres per \$) after grains (80).

Key weaknesses are:

- Low export value (\$1.3 billion, 5.0% of agricultural exports), but largest importing industry (\$1.8 billion, 48.1% of agricultural imports).
- Lowest growth potential over the next five years (-0.07% per annum between 2009-10 and 2014-15).
- Low median weekly earnings (\$709 per week) after poultry and eggs (\$700 in both).
- Second highest total water use (1,083,141 megalitres of water per annum) after sheep/beef (1,336,980 megalitres).
- Third smallest share of world output (0.3%) after rice (0.01%) and poultry (0.1%).
- Third smallest average farm size (192 hectares per farm) after poultry with 129 hectares and viticulture with 150 hectares per farm.
- Lowest share of full-time employees (69.7%).



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Appendix A: Federal Government Policy Objectives

The following reports were reviewed:

- Rural Research and Development Priorities (DAFF, 2007)
- One Biosecurity: a working partnership (DAFF, 2008)
- National Strategy for the Conservation of Australia's Biological Diversity (DEST, 1996)
- Carbon Pollution Reduction Scheme Australia's Low Pollution Future (DCC, 2008)
- Water for the Future (DEWHA, 2009)
- Powering Ideas: An Innovation Agenda for the 21st Century (DIISR, 2009)
- Australian Workforce Futures: A National Workforce Development Strategy (Skills Australia, 2010). Note: this key publication on skills did not specifically refer to agriculture.
- National Waste Policy: Less Waste, More Resources (DEWHA, 2009). Note: This key publication on waste did not specifically refer to agriculture.

No government policy could be found on food security.

Access Economics also looked into other sectors, but found no national government policy or objectives plan (e.g. similar to the Victorian state plan - 'Growing Victoria Together' (VIC DPC, 2005)) that related to agriculture/horticulture. The Australia 2020 Summit plan (DPC, 2008) Government was relevant, but was covered off by other strategy and plans. It provided a useful overview of government strategies in relevant areas.

The key policy objectives associated with each report are outlined below. Objectives of particular relevance are highlighted in red.

Rural Research and Development Priorities

Department of Agriculture, Fisheries and Forestry (2007)

- Productivity and adding value: Improve the productivity and profitability of existing industries and support the development of viable new industries.
- Supply chain and markets: Better understand and respond to domestic and international market and consumer requirements and improve the flow of such information through the whole supply chain, including consumers.
- Natural resource management: Support effective management of Australia's natural resources to ensure primary industries are both economically and environmentally sustainable.
- Climate variability and climate change: Build resilience to climate variability and adapt to and mitigate the effects of climate change.
- Biosecurity: Protect Australia's community, primary industries and environment from biosecurity threats.



- Innovation skills: Improve the skills to undertake research and apply its findings.
- Technology: Promote the development of new and existing technologies.

'One Biosecurity: a working partnership', Preliminary Commonwealth Government Response to the Independent Review of Australia's Quarantine and Biosecurity Arrangements

Department of Agriculture, Fisheries and Forestry (2008)

- Ensuring the protection of the health of all Australians, our natural environment, and a biosecurity system which supports the competitiveness and ongoing viability of our valuable farming, fishing and forestry industries.
- Creating a biosecurity system that protects the integrity of our environment, our favourable pest and disease status and the productivity of our primary producers.
- Developing a biosecurity system that involves a partnership between the Commonwealth, state and territories and industries.
- The National Agreement on Biosecurity, which is currently being negotiated between the Australian and State and Territory governments, is a principle-level agreement, including national goals and objectives, key features and attributes of the national biosecurity system and the plan for implementation. It will also commit governments to work in partnership to improve key aspects of the national biosecurity system, which was formerly part of the AusBIOSEC work.¹

National Strategy for the Conservation of Australia's Biological Diversity

Department of the Environment, Sport and Territories (1996)

The report is part of fulfilling the core objectives of the National Strategy for Ecologically Sustainable Development. Key strategies include:

- Conservation of biological diversity across Australia
 - Identify important biological diversity components and threatening processes.
 - Improve the standards of management and protection of Australia's biological diversity by encouraging the implementation of integrated management techniques.
 - Establish and manage a comprehensive, adequate and representative system of protected areas covering Australia's biological diversity.
 - Strengthen off-reserve conservation of biological diversity.
 - Ensure the maintenance of, and where necessary strengthen, existing arrangements to conserve Australia's native wildlife.



¹ Source: AUSBIOSEC (Dec 09), http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity/ausbiosec

- Enable Australia's species and ecological communities threatened with extinction to survive and thrive in their natural habitats and to retain their genetic diversity and potential for evolutionary development, and prevent additional species and ecological communities from becoming threatened.
- Recognise and ensure the continuity of the contribution of the ethnobiological knowledge of Australia's indigenous peoples to the conservation of Australia's biological diversity.
- To complement in-situ measures, establish and maintain facilities for ex-situ research into and conservation of plants, animals and microorganisms, particularly those identified by action taken in accordance with Objective 1.1.
- Integrating biological diversity conservation and natural resource management
 - Develop and implement national integrated policies for the ecologically sustainable use of biological resources. "Improved management of Australia's forests, fisheries, agricultural lands and rangelands is necessary for the industries involved and at the same time will provide considerable benefits for the conservation of biological diversity. Other sectors and areas that could also benefit from improved management are urban and coastal areas, the industrial and extractive sectors and infrastructure development."
 - Achieve the conservation of biological diversity through the adoption of ecologically sustainable agricultural and pastoral management practices.
 - Achieve the conservation of biological diversity through the adoption of ecologically sustainable fisheries management practices.
 - Achieve the conservation of biological diversity through the adoption of ecologically sustainable forestry management practices.
 - Manage water resources in accordance with biological diversity conservation objectives and to satisfy economic, social and community needs.
 - Achieve the conservation of biological diversity through the adoption of ecologically sustainable management practices for tourism and recreation.
 - Achieve the conservation of biological diversity through the adoption of other ecologically sustainable wildlife management practices.
 - Ensure that the social and economic benefits of the use of genetic material and products derived from Australia's biological diversity accrue to Australia.
- Managing threatened processes
 - Monitor, regulate and minimise processes and categories of activities that have or are likely to have significant adverse impacts on the conservation of biological diversity and be able to respond appropriately to emergency situations.
 - Ensure effective measures are in place to retain and manage native vegetation, including controls on clearing.
 - Control the introduction and spread of alien species and genetically modified organisms and manage the deliberate spread of native species outside their historically natural range.
 - Minimise and control the impacts of pollution on biological diversity.
 - Reduce the adverse impacts of altered fire regimes on biological diversity.



- Plan to minimise the potential impacts of human-induced climate change on biological diversity.
- Repair and rehabilitate areas to restore their biological diversity.
- Ensure that the potential impacts of any projects, programs and policies on biological diversity are assessed and reflected in planning processes, with a view to minimising or avoiding such impacts.
- Improving our knowledge
- Building awareness and involvement
- Implementation within the timeframe
- International agreements and cooperation

Carbon Pollution Reduction Scheme – Australia's Low Pollution Future

Department of Climate Change (2008)

- Australia's emissions reduction targets.
 - Reduce Australia's greenhouse gas emissions to 25% below 2000 levels by 2020 if the world agrees to an ambitious global agreement consistent with stabilising greenhouse gas levels at 450 parts per million or lower.
 - Reduce emissions by up to 15% on 2000 levels by 2020 in the context of an international agreement where major developing economies commit to substantially restrain emissions, and advanced economies take on commitments comparable to Australia's, but global action falls short of stabilisation at 450 ppm or lower
 - Unconditionally reduce emissions to 5% below 2000 levels by 2020 regardless of the commitments and actions of other nations.
- Pillar 1: reducing emissions
 - Establish an emissions trading system (the CPRS) as the primary policy mechanism to reduce Australia's emissions by putting a price on greenhouse gas emissions.
 - Complementary strategies to foster a low-emissions economy; support energy efficiency; reduce emissions from the transport, waste, land-use change and forestry sectors; foster carbon offsetting activities; assist with the transition to a lower emission economy; and address emissions in sectors not directly covered by the CPRS such as agriculture, deforestation and government operations.
 - "Initially, the Scheme will not cover emissions from agriculture. The agricultural sector is characterised by thousands of small emitters and the calculation of emissions is complex, so it would not be practical at this stage to cover those emissions directly. However, agriculture's eventual inclusion in the Scheme is desirable, if it can be cost-effectively achieved. Commencing in 2009 the Government will undertake a work program to enable it to determine in 2013 whether or not to cover agriculture emissions from 2015".
- Pillar 2: adapting to unavoidable climate change
 - The Australian Government is developing a comprehensive adaptation policy to prepare Australia to deal with the social, economic and environmental risks of



climate change impacts, and is building capacity to adapt to the unavoidable impacts of climate change through a range of research initiatives, research facilities, and risk assessments.

- The Australian Government's actions on adaptation have focused on building the tools and information needed to underpin sound decision making at a national level and coordinating the economic or regulatory reforms needed to address climate change risks. This important suite of measures will inform national planning, regulation and investment decisions.
- Pillar 3: Helping to shape a global solution
 - Involves working towards a global framework beyond the Kyoto Protocol.
 - A fair and effective global climate change agreement delivering deep cuts in emissions to deliver long-term stabilisation of greenhouse gas emissions at 450ppm or lower.
 - Developing mechanisms to reduce emissions from forests in developing countries (deforestation).

Water for the Future

Department of Environment, Water, Heritage and the Arts (2009)

- Taking action on climate change
 - Sustainable water diversion limits in the Murray-Darling Basin
 - Accurately monitoring, assessing and forecasting the availability, condition and use of water resources through the Bureau of Meteorology's *Improving Water Information Program*.
 - Assessing current and future water availability in the Murray-Darling Basin, Tasmania, south-west Western Australia and northern Australia through the CSIRO Sustainable Yields reports, and
 - Investigation of the development of northern Australia's
- Using water wisely
 - Sustainable Rural Water use and Infrastructure program
 - Improve the efficiency and productivity of on-farm irrigation water use and management through the On-Farm Irrigation Efficiency Program.
 - Help irrigation water providers develop modernisation plans for their districts, upgrade irrigation infrastructure and assess options to adapt to a future with less water with Irrigation Modernisation Planning Assistance, and
 - Provide funding to private irrigation infrastructure operators to modernise and upgrade irrigation infrastructure through the Private Irrigation Infrastructure Operators program.
 - By reforming the water market to establish cooperative, efficient and effective planning and management arrangements for the Basin's water and other natural resources.
 - Installation of rainwater tanks and greywater systems National Rainwater and Greywater Initiative, and



- The Water Efficiency Labelling and Standards (WELS) Scheme.
- Securing water supplies
 - Helping towns and cities secure their water supplies.
- Supporting healthy rivers and wetlands
 - Buying back water entitlements.
 - Establishing the Commonwealth Environmental Water Holder to manage water entitlements and allocate Commonwealth water to environmental assets that need to be protected.
 - Setting a new cap on the amount of water that can be taken out of rivers and groundwater systems in the Murray-Darling Basin.

Powering Ideas: An Innovation Agenda for the 21st Century

Department of Innovation, Industry, Science and Research (2009)

- Our objective is to build a stronger national innovation system. This will involve investment in reform and renewal. It will involve setting priorities and strengthening coordination; improving skills and expanding research capacity; increasing innovation in business, government and the community sector; and boosting collaboration domestic and international — across the system.
- To build a stronger national innovation system.
- Setting priorities and strengthening coordination
- Improving skills and expanding research capacity
 - Public research
 - University research
 - Public research agencies
 - Cooperative research centres
 - Sectoral research:
 - *"Primary industry research* Primary industry (agriculture, fisheries and forestry) has been a focus of public sector research in Australia since the nineteenth century, and the Commonwealth, states and territories are still very active in the field today. The Australian Government supports this effort through Rural Research and Development Corporations, various Cooperative Research Centres, universities, and CSIRO, which devotes about a third of its budget some \$300 million annually to agricultural research."
 - Medical research
 - Defence capability research
- Increasing business innovation
- Public sector innovation
- Boosting collaboration



Australian Workforce Futures – A National Workforce Development Strategy

Skills Australia (2010)

- Sustain economic growth and raise productivity by increasing skills and avoiding future skills shortages
- Lift the workforce participation rate to 69 per cent by 2025 to provide the required workforce and improve social inclusion
- Improving adult language, literacy and numeracy skills
- Better using skills to increase productivity (increase productivity, employee engagement and job satisfaction by making better use of skills in the workplace)
- Enhancing the capability of the tertiary education sector
- Creating a shared agenda on workforce futures

National Waste Policy: Less Waste, More Resources

Department of the Environment, Water, Heritage and the Arts (2009)

- Support business and consumers to appropriately manage end-of-life products, materials and packaging.
- Support waste avoidance, reduction, recovery and re-use by addressing market impediments and removing red tape.
- To enhance biodegradable (organic) resource recovery and reduce greenhouse gas emissions from landfills.
- To avoid waste and increase recovery and re-use of wastes from the commercial and industrial and construction and demolition waste streams.
- A comprehensive nationally integrated system for the identification, classification, collection, treatment, disposal and monitoring of hazardous substances and waste that aligns with international obligations.
- Develop a national system to reduce potentially hazardous substances available in Australia.
- Support improved waste management and re-use of waste in regional, remote and Indigenous communities.
- Develop capacity to effectively collect consistent, accurate and meaningful national waste and resource recovery data to inform policy and decisions.

