

Contribution of Australian horticulture industry

**A GENERAL EQUILIBRIUM ANALYSIS
FULL REPORT**



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Contents

Summary	1
Methodology	1
The current contribution of horticulture industry	2
The potential future contribution of horticulture industry	9
Case study regions	13
1 Introduction	20
Background	20
Measuring economic activity	20
Contribution of an industry to the economy	21
This report	23
2 Methodology	24
A general equilibrium modelling framework	24
Models used	25
Data sources	27
Stakeholder consultation	29
3 Horticulture industry in Australia	31
National summary	31
Regional summary	33
Horticulture contribution to economy	39
4 Horticulture industry outlook	45
Outlook assumptions	46
National outlook	47
Regional outlook	57
Projected contribution to the economy	60
5 Horticulture industry in case study regions	65
Coffs Harbour – Grafton	65
Mildura	70
Cairns/Mareeba	75
Adelaide Plains	80
A Models used	86
B Assumptions for horticulture industry outlook	96

BOXES, CHARTS AND TABLES

1	Horticulture regions for the analysis	2
2	National contribution of the horticulture industry	3
3	Horticulture industry, 2020-21	4
4	Regional horticulture industry summary, 2020-21	4
5	Horticultural industry contribution to GRP in 2020-21	6
6	Horticultural industry contribution to regional employment in 2020-21	8
7	Projected horticulture GVP by scenario	9
8	Comparison of total horticulture contribution to GDP by scenarios	10
9	Comparison of total horticulture contribution to employment by scenario	11
10	Contribution to GRP in 2029-30, Central Scenario	11
11	Contribution to regional employment in 2029-30, Central scenario	12
2.1	Modelling framework	25
2.2	Horticulture regions for the analysis	27
3.1	National horticulture production, value added and employment in 2020-21	31
3.2	Regional horticulture industry summary	34
3.3	Regional horticulture sector structure	36
3.4	Horticulture share in GRP	38
3.5	Horticultural share in GSP and GDP	39
3.6	Sectoral impacts of horticulture growing and processing	39
3.7	Direct and indirect contribution of horticultural industry to GSP in 2020-21	41
3.8	Direct and indirect employment impact of horticultural industry in 2020-21	42
3.9	Horticultural industry contribution to GRP in 2020-21	42
3.10	Horticultural industry contribution to regional employment in 2020-21	43
4.1	Summary of outlook assumptions	46
4.2	Projected horticulture GVP by scenario	48
4.3	Comparison of projected horticulture GVP growth	48
4.4	Comparison of sectoral GVP in 2030 under different scenarios	50
4.5	Projected Australian horticulture GVP by broad category, Central scenario	52
4.6	Projected horticulture value added by broad category, Central scenario	52
4.7	Projected horticulture employment, Central scenario	53
4.8	Projected national horticulture production, value added and employment in 2029-30, Central scenario	53
4.9	Comparison of nuts projections	56
4.10	Regional horticulture GVP comparison under different scenarios (2029-30)	57
4.11	Projected regional horticulture production, value added and employment under Central scenario	58
4.12	Comparison of total horticulture contribution to GDP by scenarios	60
4.13	Projected contribution to GDP under the Central scenario	61

4.14	Projected contribution to GSP in 2029-30 under the Central scenario	61
4.15	Contribution to GRP in 2029-30 under the Central scenario	61
4.16	Projected horticulture contribution to employment under the Central scenario	63
4.17	Contribution to regional employment in 2029-30 under the Central scenario	63
5.1	Coffs Harbour – Grafton region	65
5.2	Population and labour force in Coffs Harbour – Grafton	66
5.3	Economic structure in Coffs Harbour – Grafton, 2020-21	67
5.4	Horticulture industry in Coffs Harbour – Grafton, 2020-21	67
5.5	Estimated horticulture contribution in Coffs Harbour – Grafton, 2020-21	68
5.6	Projected horticulture GVP in Coffs Harbour – Grafton	68
5.7	Central case projection for Coffs Harbour – Grafton	69
5.8	Projected horticulture contribution in Coffs Harbour – Grafton in 2029-30	69
5.9	Mildura region	70
5.10	Population and labour force in Mildura	71
5.11	Economic structure of Mildura, 2020-21	72
5.12	Horticulture industry in Mildura, 2020-21	72
5.13	Horticulture industry contribution in Mildura, 2020-21	73
5.14	Projected horticulture GVP in Coffs Harbour – Mildura	73
5.15	Central case projection of horticulture industry in Mildura	74
5.16	Projected horticulture contribution in Mildura in 2029-30	74
5.17	Cairns/Mareeba region	75
5.18	Population and labour force in Cairns	76
5.19	Economic structure of Cairns/Mareeba, 2020-21	77
5.20	Horticulture industry in Cairns, 2020-21	77
5.21	Horticulture industry contribution in Cairns, 2020-21	78
5.22	Projected horticulture GVP in Cairns	78
5.23	Central case projection of horticulture industry in Cairns	79
5.24	Projected horticulture contribution in Cairns in 2030	79
5.25	Adelaide Plains region	80
5.26	Population and labour force in Adelaide Plains	81
5.27	Economic structure of Adelaide Plains, 2020-21	82
5.28	Horticulture industry in Adelaide Plains, 2020-21	82
5.29	Horticulture industry contribution in Adelaide Plains, 2020-21	83
5.30	Projected horticulture GVP in Adelaide Plains	83
5.31	Central case projection of horticulture industry in Adelaide Plains	84
5.32	Projected horticulture contribution in Adelaide Plains in 2029-30	85
A.1	Sectors identified by the FP model	86
A.2	Aggregate value chain for Australian agriculture and food processing	88
A.3	Commodities and sectors identified in HI-LINK model	90

A.4	The structure of the HI-LINK model	91
A.5	Commodity concordance	91
A.6	Horticulture regions for the analysis	94
A.7	Regional concordance	94
B.1	Historical and assumed world economic growth	97
B.2	Exchange rate	97
B.3	Total value of horticulture exports	98
B.4	Annual growth rate of horticulture exports between 2012-13 and 2020-21	99
B.5	ABARES projection of horticulture exports growth	99
B.6	Historical and projected Australian income growth	100
B.7	Historical and projected Australian population growth	101
B.8	Total factor productivity in cropping	102
B.9	Multifactor productivity in manufacturing	103
B.10	Annual change in wage price	104
B.11	Labour productivity and real wage growth in Australia	105
B.12	Unemployment rate and participation rate in Australia	105
B.13	Water storages and average price in the Murray-Darling Basin	106
B.14	Petroleum products and chemicals price index	107
B.15	Crude oil and oil products price projections	108
B.16	Assumed petroleum products price	109
B.17	Projected natural gas price indexes versus historical chemicals price index	110
B.18	Historical and assumed price change for natural gas and chemical products	111
B.19	Scenario assumptions for chemicals price change	111

Summary

Horticulture is an important Australian industry with a farm gate value of production of \$15.2 billion in 2020-21¹. The horticulture growing industry employs about 64 650 full-time equivalent (FTE) persons and has value added of \$9.6 billion.

Including processing of horticultural products, the industry has a gross value of production (GVP) of \$17.8 billion, employs about 69 700 persons (FTE) and generates value added of around \$10.2 billion².

To support the horticulture industry in understanding its broader contributions to national and regional economies, now and in the future, the Centre for International Economics (CIE) was commissioned by Hort Innovation to undertake economic analysis including:

- estimating the current and future contribution of the horticulture industry to the national, state and regional economies
- projecting the horticulture industry to 2030;³ and
- undertaking broad regional analysis with detailed case studies in four key horticulture regions (Cairns – Mareeba in Queensland, Coffs Harbour – Grafton in New South Wales, Mildura in Victoria and Adelaide Plains in South Australia).

The study involves comprehensive data and modelling analysis with detailed horticulture commodity coverage.

Methodology

This study uses a well established modelling framework (a general equilibrium framework) combining three economic models:

- CIE FP model, a computable general equilibrium model of Australian economies with detailed description of food value chains;

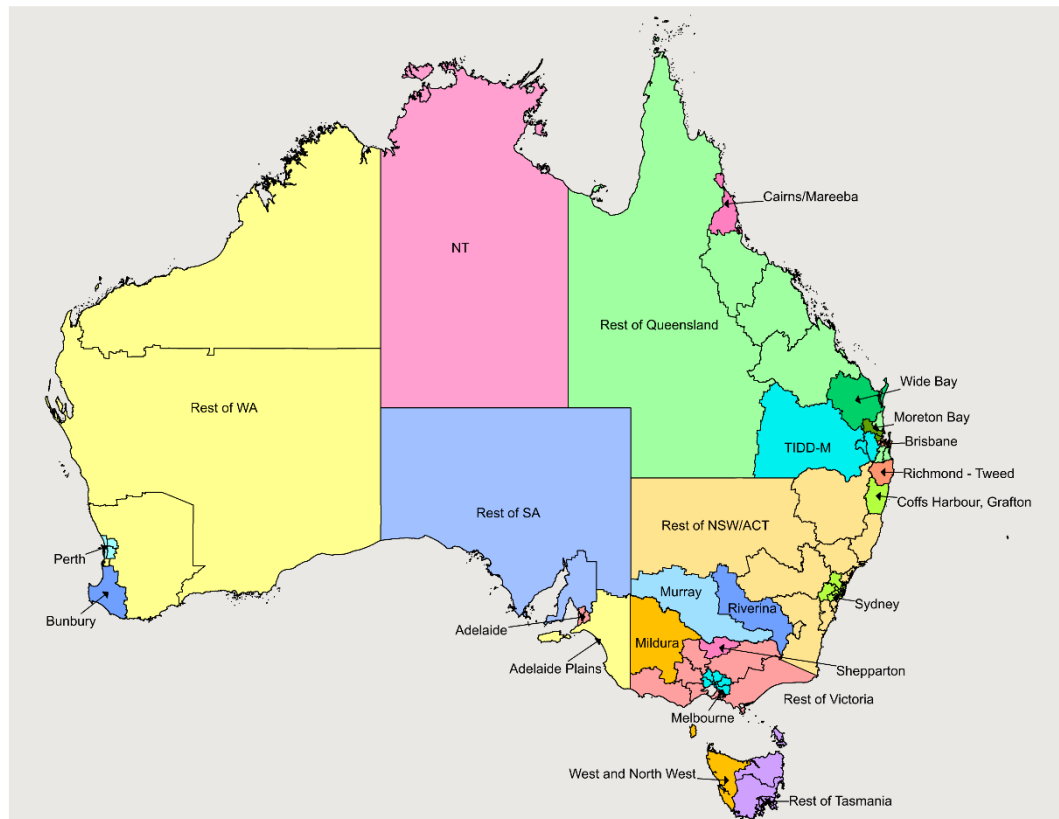
1 Hort Innovation 2022, *Australian Horticulture Statistics Handbook 2020/21*, February 2022, available at <https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/grower-resources/ha18002-assets/australian-horticulture-statistics-handbook/>

2 Note that throughout this report also uses Australian Bureau of Statistics employment and census data. This provides an annual snapshot, but does not necessarily capture seasonal variations throughout the year.

3 Year in this report refers to financial year ending 30 June of the corresponding year, for example 2030 means financial year 2029-30.

- HI_LINK, a detailed horticulture value chain model identifies 48 horticulture farming and processing commodities; and
- A Regional Module, to transform the state-level results into 25 regions (chart 1).

1 Horticulture regions for the analysis



Note: TIDD-M: Toowoomba, Ipswich, Darling Downs - Maranoa

Data source: CIE

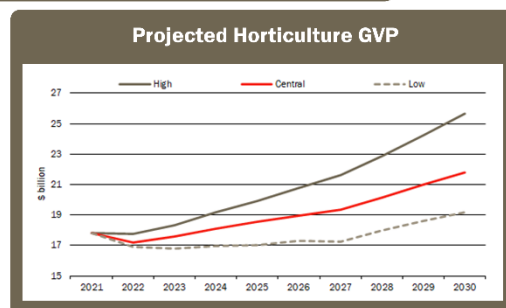
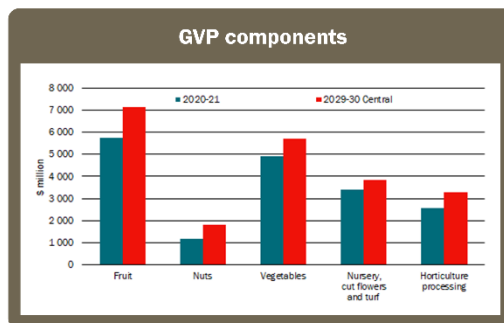
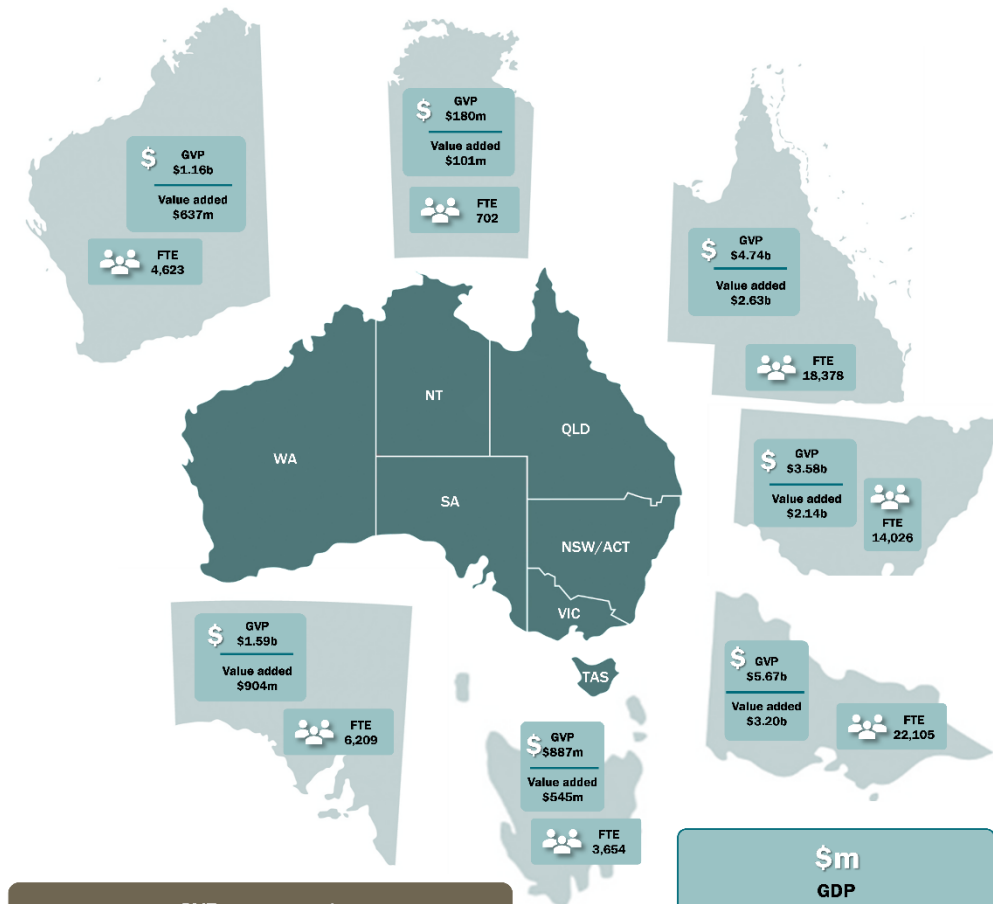
In addition to the general equilibrium framework, stakeholders were also consulted to seek feedback on the CIE's initial estimates and gain more insights on the horticulture industry and regional specifics.

The current contribution of horticulture industry

National summary

Chart 2 provides a national summary of the Australian horticulture industry.

2 National contribution of the horticulture industry



\$m		
GDP Contribution		
	2020-21	2029-30 Central
Direct	10,158	12,441
Indirect	2,804	3,413
Total	12,963	15,854

Employment Contribution		
	2020-21	2029-30 Central
Direct	69,697	76,372
Indirect	14,835	17,914
Total	84,532	94,286



Data source: CIE estimates

A few key points to note on this chart:

- The **gross value of production (GVP)** refers to the total value of all commodities produced by the industry

- **Value added** refers to payments to labour, capital and land used to produce those commodities
- **FTE** refers to the full-time equivalent number of employees in the industry.
- **Contribution to GDP** refers to the dollar amount by which the industry contributes to the total economy's gross domestic product.
- The **direct** contribution to GDP refers to the activities within the horticulture industry itself, the **indirect** contribution refers to additional economic activity induced elsewhere in the economy by the horticulture industry itself.
- As explained below, projections for future values of these variables are mad under three scenarios, Central, High and Low.

Data from the Australian Horticulture Statistics Handbook compiled by Hort Innovation and ABS statistics indicates that the gross value of production (GVP) of the horticulture industry was \$17.8 billion in 2020-21, including \$2.6 billion from horticulture processing (table 3). The GVPs are calculated using the farm/factory gate price, and thus are equivalent to the local value in the ABS statistics. The industry's value added (income to production factors such as land, labour and capital) was \$10.2 billion, and the employment was about 69 700 full-time equivalent (FTE) (table 3).

3 Horticulture industry, 2020-21

	GVP	Value added	Employment
	\$m	\$m	FTE
Fruit	5,752.3	3,985.9	22,916
Nuts	1,196.2	878.1	4,460
Vegetables	4,913.8	2,561.0	23,277
Nursery, cut flowers and turf	3,387.7	2,186.2	13,993
Horticulture processing	2,558.1	547.1	5,051
Total	17,808.1	10,158.3	69,697

Source: CIE estimates based on Australian Horticulture Statistics Handbook and ABS data

Regional summary

Table 4 provides a summary of the regional horticulture industry in 2020-21.

4 Regional horticulture industry summary, 2020-21

	GVP	Value added	Employment
	\$m	\$m	FTE
New South Wales and ACT			
Coffs Harbour - Grafton	441.4	348.8	2,262
Richmond - Tweed	371.5	238.6	1,439
Riverina	636.7	420.9	2,259
Murray	391.1	240.3	1,546

	GVP	Value added	Employment
	\$m	\$m	FTE
Sydney	1,057.1	465.0	3,841
Rest of NSW/ACT	687.0	424.3	2,678
NSW/ACT total	3,584.8	2,137.8	14,026
Victoria			
North West (Mildura)	1,689.5	1,074.5	6,932
Shepparton	1,221.9	644.1	3,769
Melbourne	1,546.7	840.7	6,531
Rest of Victoria	1,208.2	647.5	4,873
Victoria total	5,666.3	3,206.8	22,105
Queensland			
Cairns (Cairns/Mareeba)	862.7	515.0	3,253
Wide Bay	985.7	601.1	3,887
Moreton Bay	307.4	185.8	1,307
Brisbane	362.1	137.1	995
TIDD-M	911.1	453.4	3,655
Rest of Queensland	1,313.0	734.1	5,282
Queensland total	4,741.8	2,626.5	18,378
South Australia			
South Australia - South East (Adelaide Plains)	941.5	587.9	3,649
Adelaide	562.5	277.0	2,170
Rest of SA	82.2	39.2	390
SA total	1,586.2	904.2	6,209
Western Australia			
Perth	412.7	220.5	1,662
Bunbury	405.6	229.4	1,520
Rest of WA	343.1	187.3	1,441
WA total	1,161.4	637.3	4,623
Tasmania			
West and North West	346.9	203.6	1,500
Rest of Tasmania	540.2	341.0	2,154
Tasmania total	887.1	544.7	3,654
Northern Territory			
NT	180.5	101.2	702
Australia	17,808.1	10,158.3	69,697

Note: data for 2020-21; TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE estimates

Among all the 25 regions nationally, North West (Mildura) in Victoria is the most significant horticultural growing region with a GVP of \$1.69 billion, a value added of

\$1.07 billion and employment of more than 6 930 persons FTE. Melbourne is the second largest region in horticulture growing (especially vegetables) and processing, with a GVP of \$1.55 billion, a value added of \$841 million, and employment of about 6 530 persons FTE. The Rest of Queensland is the third largest region in horticulture growing and processing, with a GVP of \$1.31 billion, a value added of \$734 million and employment of 5 280 persons FTE.

Shepparton in Victoria is the fourth largest horticulture region in terms of GVP (\$1.22 billion). It is followed by Rest of Victoria (\$1.21 billion), Sydney (\$1.06 billion), Wide Bay region in Queensland (\$986 million), South East (Adelaide Plains) in South Australia (\$942 million), Toowoomba, Ipswich, Darling Downs – Maranoa (TIDD-M) region in Queensland (\$911 million), and Cairns/Mareeba (\$863 million).

Greater Melbourne and Greater Sydney are among the top 10 horticulture regions because they have a relatively significant horticulture processing industry, vegetable sector and amenity horticulture including nurseries, cultivated turf and cut flowers that serve the urban population. For example, Sydney produces \$453 million of processed horticultural products, accounting for 43 per cent of its horticultural GVP, with another \$339 million (32 per cent) from nursery, cultivated turf and cut flowers, and \$257 million (24 per cent) from vegetables including about \$113 million of mushrooms growing.

These top 10 regions account for about two thirds of the nation's horticulture growing and processing GVP, value added and employment.

Contributions of the horticulture industry

It is estimated that for every dollar of horticultural value added, about additional 27.6 cents is induced in the rest of the economy. Value added of an industry is the income generated from production factors including labour, land (natural resources) and capital and entrepreneurship, which is the new value generated in the production process of the industry as opposed to intermediate inputs which are products or services created in other industries. Gross value added from all industries contributes a majority (over 93 per cent) of an economy in terms of gross regional product (GRP), gross state product (GSP) or gross domestic product (GDP).

The horticulture industry has a total contribution of \$12.96 billion to the national economy, including direct contribution of \$10.16 billion and \$2.80 billion indirect contribution (table 5).

5 Horticultural industry contribution to GRP in 2020-21

	Direct	Indirect	Total
	\$m	\$m	\$m
NSW/ACT			
Coffs Harbour - Grafton	348.8	85.8	434.6
Richmond - Tweed	238.6	74.1	312.7
Riverina	420.9	114.4	535.3

	Direct	Indirect	Total
	\$m	\$m	\$m
Murray	240.3	68.7	309.0
Sydney	465.0	239.6	704.6
Rest of NSW/ACT	424.3	140.6	564.9
NSW total	2,137.8	723.2	2,861.0
Victoria			
North West	1,074.5	201.3	1,275.8
Shepparton	644.1	181.1	825.2
Melbourne	840.7	303.6	1,144.3
Rest of Victoria	647.5	187.3	834.8
Victoria total	3,206.8	873.3	4,080.1
Queensland			
Cairns	515.0	82.2	597.2
Wide Bay	601.1	104.3	705.4
Moreton Bay	185.8	43.8	229.6
Brisbane	137.1	55.8	192.9
TIDD-M	453.4	112.7	566.2
Rest of Queensland	734.1	176.7	910.8
Queensland total	2,626.5	575.5	3,202.0
South Australia			
South Australia - South East	587.9	170.3	758.2
Adelaide	277.0	129.2	406.3
Rest of SA	39.2	15.0	54.2
SA total	904.2	314.5	1,218.7
Western Australia			
Perth	220.5	64.4	285.0
Bunbury	229.4	62.3	291.7
Rest of WA	187.3	48.5	235.8
WA total	637.3	175.2	812.5
Tasmania			
West and North West	203.6	42.2	245.9
Rest of Tasmania	341.0	72.1	413.1
Tasmania total	544.7	114.3	659.0
Northern Territory			
NT	101.2	28.3	129.5
National	10,158.3	2,804.4	12,962.8

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE modelling

The induced employment is about 21.3 per cent of total direct employment in the industry, less than the ratio of value added induced by the industry as discussed above. This is because the horticulture industry is more labour intensive than other industries. The boost in other industries has relatively smaller employment impact as opposed to the growth in horticulture industry. It is estimated that the horticulture industry would induce about 14 835 additional FTEs in other industries, leading to a total employment contribution of about 84 530 FTEs (table 6).

6 Horticultural industry contribution to regional employment in 2020-21

	Direct	Indirect	Total
	FTE	FTE	FTE
NSW/ACT			
Coffs Harbour - Grafton	2,262	261	2,523
Richmond - Tweed	1,439	295	1,734
Riverina	2,259	390	2,649
Murray	1,546	244	1,789
Sydney	3,841	1,017	4,859
Rest of NSW/ACT	2,678	554	3,232
NSW total	14,026	2,761	16,786
Victoria			
North West	6,932	907	7,839
Shepparton	3,769	863	4,632
Melbourne	6,531	1,708	8,239
Rest of Victoria	4,873	1,008	5,881
Victoria total	22,105	4,486	26,591
Queensland			
Cairns	3,253	461	3,714
Wide Bay	3,887	588	4,475
Moreton Bay	1,307	283	1,590
Brisbane	995	394	1,389
TIDD-M	3,655	681	4,336
Rest of Queensland	5,282	1,108	6,390
Queensland total	18,378	3,515	21,893
South Australia			
South Australia - South East	3,649	1,002	4,651
Adelaide	2,170	813	2,982
Rest of SA	390	95	485
SA total	6,209	1,909	8,119
Western Australia			
Perth	1,662	515	2,177
Bunbury	1,520	422	1,942

	Direct	Indirect	Total
	FTE	FTE	FTE
Rest of WA	1,441	344	1,785
WA total	4,623	1,281	5,904
Tasmania			
West and North West	1,500	303	1,803
Rest of Tasmania	2,154	505	2,659
Tasmania total	3,654	808	4,462
Northern Territory			
NT	702	76	778
National	69,697	14,835	84,532

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

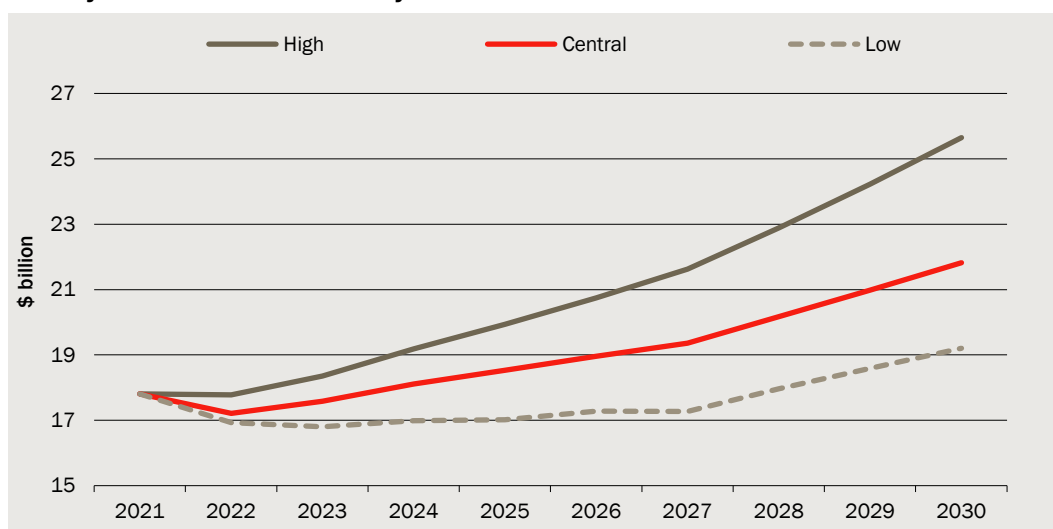
Source: CIE modelling

The potential future contribution of horticulture industry

Horticulture industry outlook

Three scenarios (High, Central and Low) were developed to acknowledge the uncertainties associated with macroeconomic as well as industrial conditions. Detailed assumptions about these scenarios are presented in appendix B of this report. Chart 7 reports the projected horticulture GVP under these three scenarios in details.

7 Projected horticulture GVP by scenario



Data source: CIE modelling

It is projected that the gross value of product (GVP) will reach \$21.8 billion (with an average annual growth rate of 2.3 per cent) under the Central scenario, \$25.6 billion (4.1 per cent average annual growth) under the High scenario or \$19.2 billion (only 0.8 per

cent growth average annual growth) under the Low scenario by 2030. The High and Low scenarios present a deviation of 18 per cent above and a 12 per cent below, respectively, the projected GVP in 2029-30 under the Central case.

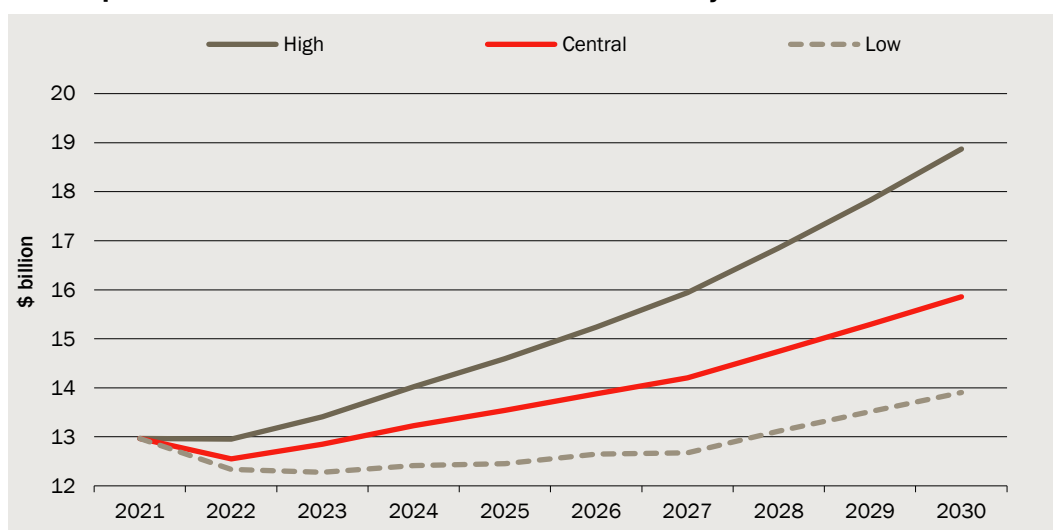
The projected fall in 2021-22, which exceeds the ABARES March 2022 outlook,⁴ is due to more severe input cost hikes as a result of the Russia-Ukraine war and consequent sanctions.

Projected horticulture industry contribution

Total contribution by scenarios

It is estimated that the total contribution (value added in horticulture industry plus induced value added in other industries) of the horticulture industry to GDP in 2030 will be \$15.85 billion, \$18.87 billion and \$13.91 billion, respectively, under the Central, High and Low scenarios (chart 8). The deviations of the High and Low scenarios from the Central scenario are similar to those in GVP and value added in percentage terms.

8 Comparison of total horticulture contribution to GDP by scenarios

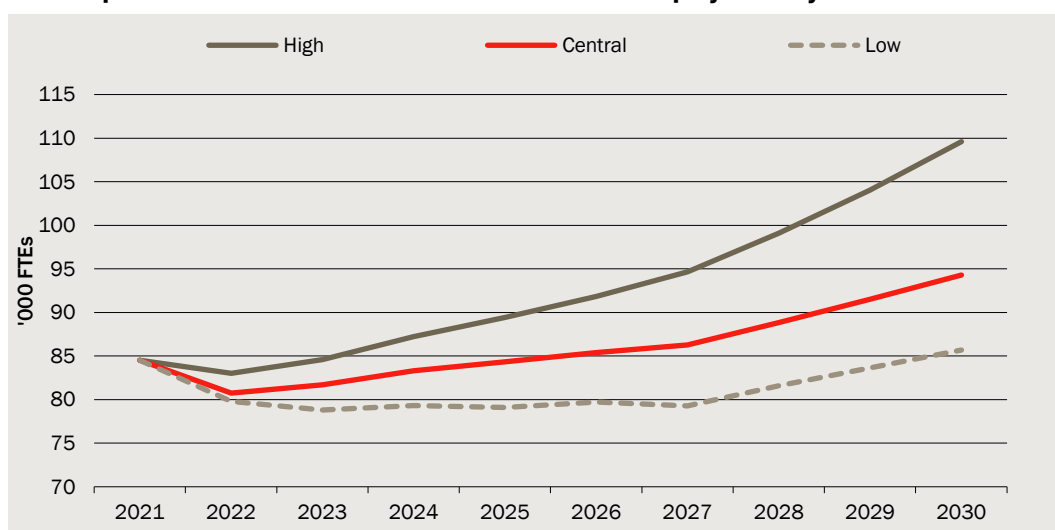


Data source: CIE modelling

As for the employment contribution, it is estimated that the industry will contribute 94 286 FTEs under the Central scenario (chart 9). The employment contribution under the High and Low scenarios presents a 16 per cent and 9 per cent deviation, respectively, from the Central scenario.

⁴ The latest September 2022 outlook (https://daff.ent.sirsidynix.net.au/client/en_AU/search/asset/1033941/1) did not provide details for horticulture industry.

9 Comparison of total horticulture contribution to employment by scenario



Data source: CIE modelling

Regional contribution under the Central scenario

Tables 10 and 11 report the industry's contribution to Gross Regional Product (GRP) and regional employment in 2029-30 under the Central scenario.

10 Contribution to GRP in 2029-30, Central Scenario

	Direct	Indirect	Total
	\$m	\$m	\$m
New South Wales and ACT			
Coffs Harbour - Grafton	405.7	102.5	508.1
Richmond - Tweed	323.8	95.7	419.5
Riverina	560.5	150.1	710.6
Murray	304.8	85.9	390.8
Sydney	540.6	282.3	823.0
Rest of NSW/ACT	512.1	168.9	680.9
NSW/ACT total	2,647.5	885.3	3,532.9
Victoria			
North West	1,426.2	261.8	1,687.9
Shepparton	774.9	229.9	1,004.8
Melbourne	976.6	354.6	1,331.2
Rest of Victoria	767.0	222.5	989.4
Victoria total	3,944.6	1,068.7	5,013.3
Queensland			
Cairns	602.7	96.0	698.7
Wide Bay	794.1	134.1	928.3
Moreton Bay	216.2	51.2	267.4

Brisbane	159.1	65.2	224.3
TIDD-M	529.7	132.5	662.3
Rest of Queensland	874.6	208.1	1,082.7
Queensland total	3,176.4	687.2	3,863.6
South Australia			
South Australia - South East	762.7	214.4	977.1
Adelaide	327.5	154.2	481.7
Rest of SA	45.0	17.3	62.3
SA total	1,135.1	385.9	1,521.0
Western Australia			
Perth	255.9	77.0	332.9
Bunbury	282.4	77.6	360.0
Rest of WA	225.9	58.6	284.5
WA total	764.2	213.2	977.4
Tasmania			
West and North West	241.2	50.7	291.9
Rest of Tasmania	409.4	87.6	497.0
Tasmania total	650.6	138.3	788.9
Northern Territory			
NT	122.8	34.4	157.2
Australia	12,441.3	3,413.2	15,854.4

Source: CIE modelling

11 Contribution to regional employment in 2029-30, Central scenario

	Direct	Indirect	Total
	FTE	FTE	FTE
New South Wales and ACT			
Coffs Harbour - Grafton	2,367	316	2,684
Richmond - Tweed	1,767	367	2,134
Riverina	2,660	503	3,163
Murray	1,755	301	2,056
Sydney	4,059	1,198	5,257
Rest of NSW/ACT	2,880	660	3,540
NSW/ACT total	15,489	3,345	18,834
Victoria			
North West	8,128	1,162	9,290
Shepparton	4,142	1,098	5,240
Melbourne	6,822	1,989	8,811
Rest of Victoria	5,144	1,192	6,336
Victoria total	24,236	5,441	29,677

Queensland			
Cairns	3,450	537	3,987
Wide Bay	4,645	750	5,394
Moreton Bay	1,364	331	1,695
Brisbane	1,066	461	1,527
TIDD-M	3,849	803	4,652
Rest of Queensland	5,659	1,302	6,961
Queensland total	20,034	4,183	24,217
South Australia			
South Australia - South East	4,198	1,252	5,451
Adelaide	2,305	970	3,275
Rest of SA	401	109	510
SA total	6,904	2,331	9,235
Western Australia			
Perth	1,733	608	2,340
Bunbury	1,719	524	2,242
Rest of WA	1,560	414	1,974
WA total	5,011	1,545	6,556
Tasmania			
West and North West	1,610	364	1,973
Rest of Tasmania	2,311	614	2,924
Tasmania total	3,920	977	4,898
Northern Territory			
NT	778	92	870
Australia	76,372	17,914	94,286

Source: CIE modelling

Case study regions

Four key horticulture regions are chosen for case studies:

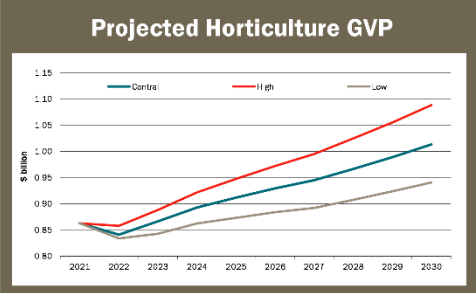
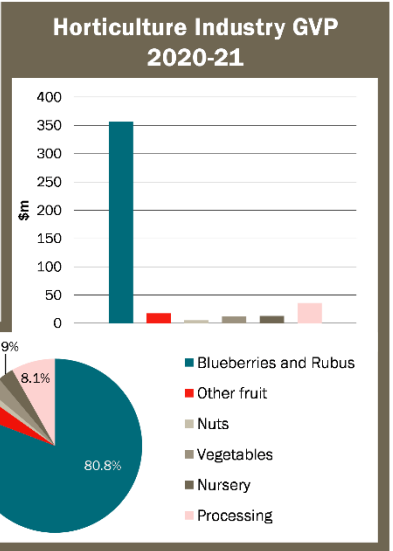
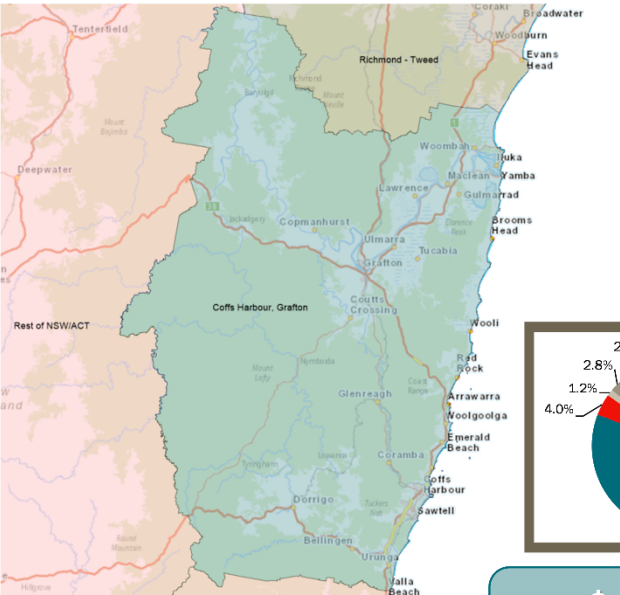
- Coffs Harbour – Grafton region in New South Wales;
- Mildura region in Victoria;
- Cairns – Mareeba region in Queensland; and
- Adelaide Plains in South Australia.

The following discussion and infographics summarise the findings for these case study regions.

Coffs Harbour – Grafton region

- The total value of horticulture industry was \$441 million in 2020-21, with a value added of \$349 million (3.61 per cent of GRP) and employment of 2 262 FTEs (3.93 per cent of regional employment).
- Berries (blueberries and Rubus berries) production is the most significant horticulture sector in the region, accounting for about 88 per cent of horticulture growing (excluding processing) or 81 per cent of total horticulture (including processing) in the region. The region produces more than half of the nation's berry production.
- The horticulture industry in the region contributed directly \$349 million to the GRP and induced another \$85.8 million in GRP in 2020-21.
- The direct employment of the industry was 2 262 FTEs, with another indirect employment of about 261 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 18 per cent to \$522 million by 2029-30 under the Central scenario, with a range from \$476 million under the Low scenario to \$569 million under the High scenario.
 - Future growth could be further enhanced if export market will be developed. Currently the horticulture sector in the region is dominated by berry production which is mainly for domestic consumption and has limited future growth.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$468-550 million by 2029-30 while total employment contribution to be 2 531 to 2 856 FTEs.

Coffs Harbour and Grafton



\$m GRP Contribution 2020-2021

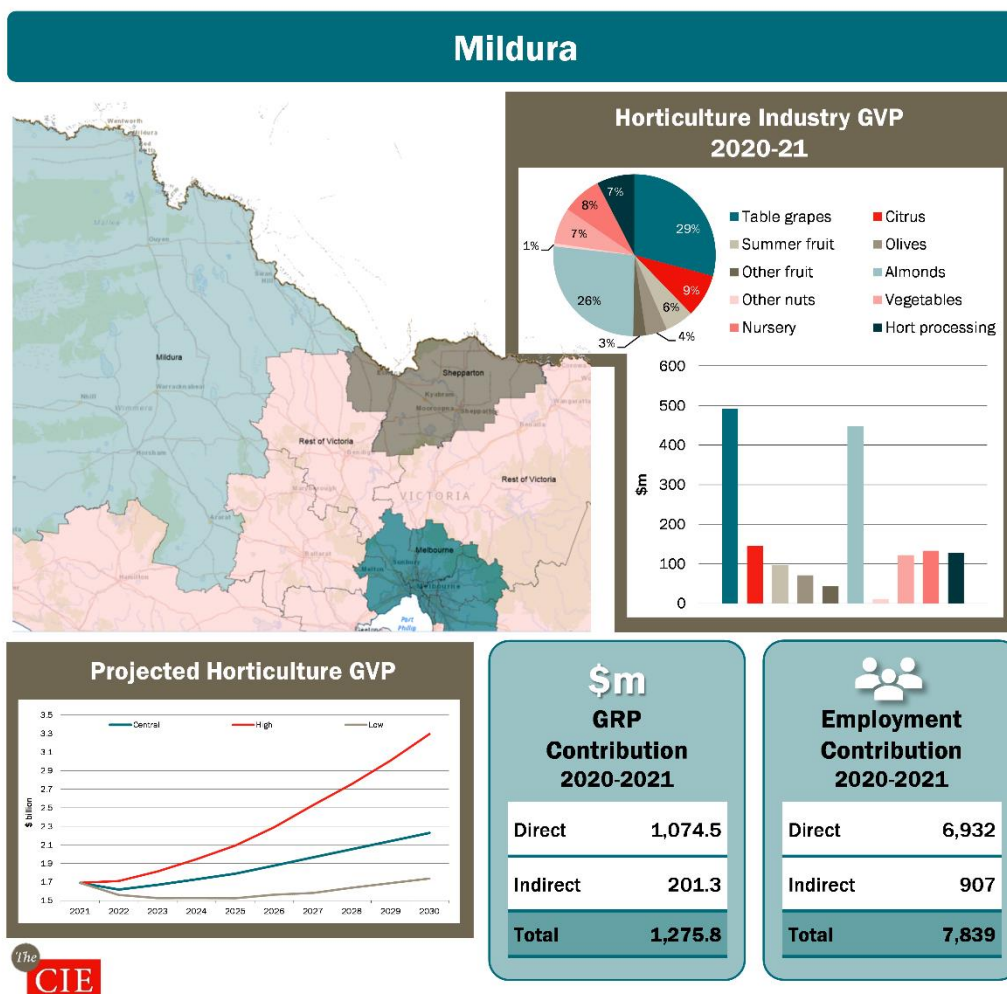
Direct	348.8
Indirect	85.8
Total	434.6

Employment Contribution 2020-2021

Direct	2,262
Indirect	261
Total	2,523



Mildura region

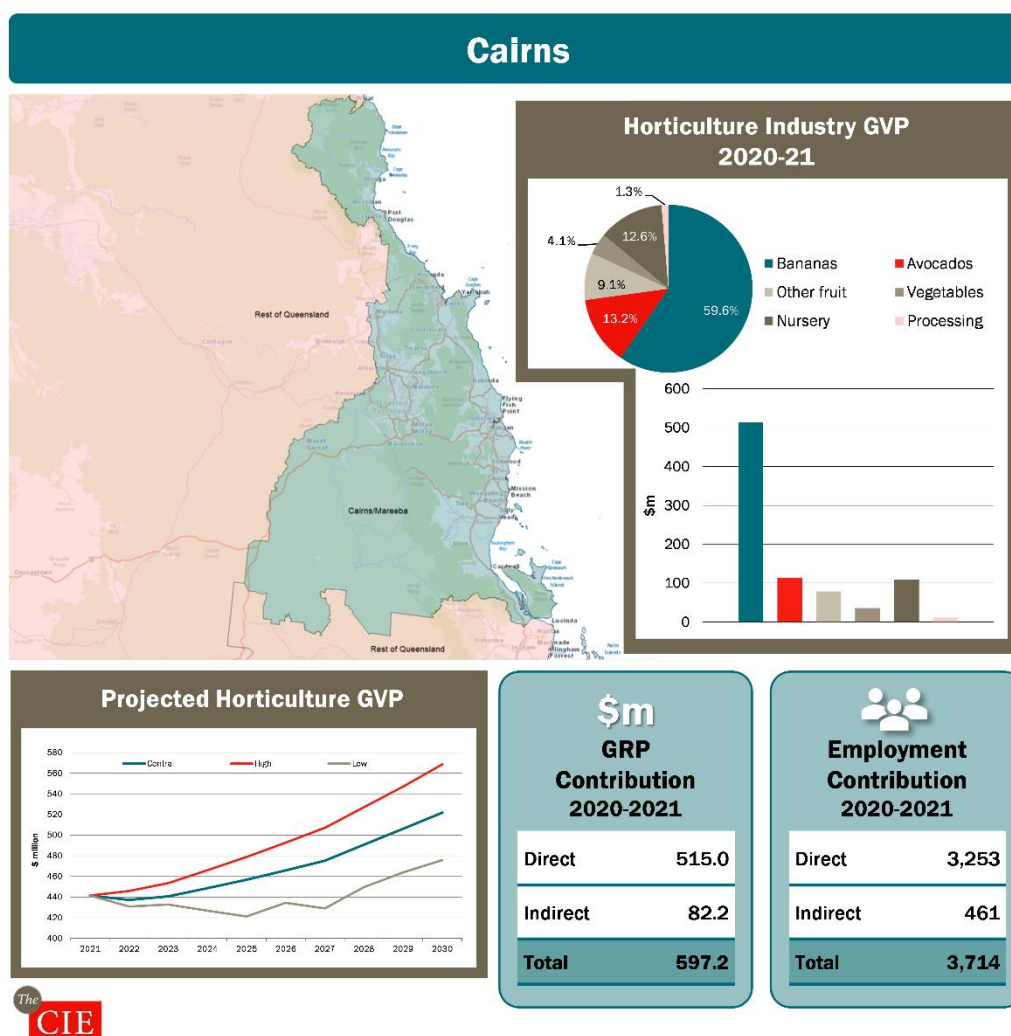


- Horticulture is a significant industry in the region. The total value of horticulture industry was \$1.7 billion in 2020-21, with a value added of \$1.1 billion (10.1 per cent of GRP) and employment of 6 932 FTEs (9.3 per cent of regional employment).
- Table grapes and almonds are the top two horticulture crops in the region, accounting for 29 per cent and 27 per cent, respectively, of the horticulture industry's GVP.
 - The region produces 78 per cent of the nation's table grapes and 62 per cent of the nation's almond production.
- The horticulture industry in the region contributed directly \$1.1 billion to the GRP and induced another \$201 million in GRP in 2020-21.
- The direct employment of the industry was 6 932 FTEs, with another indirect employment of about 907 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 32 per cent to \$2.2 billion by 2029-30 under the Central scenario, with a range from \$1.7 billion under the Low scenario to \$3.3 billion under the High scenario.
 - The projection demonstrates the importance of export market. The region's major horticulture crops – table grapes (with an export share of 60 per cent) and almonds

(with an export share of 75 per cent) – are projected to have higher growth than the industry’s average.

- Total (direct and indirect) contribution of the industry to GRP is projected to be \$1.3-2.6 billion by 2029-30 while total employment contribution to be 7 757 to 13 525 FTEs.

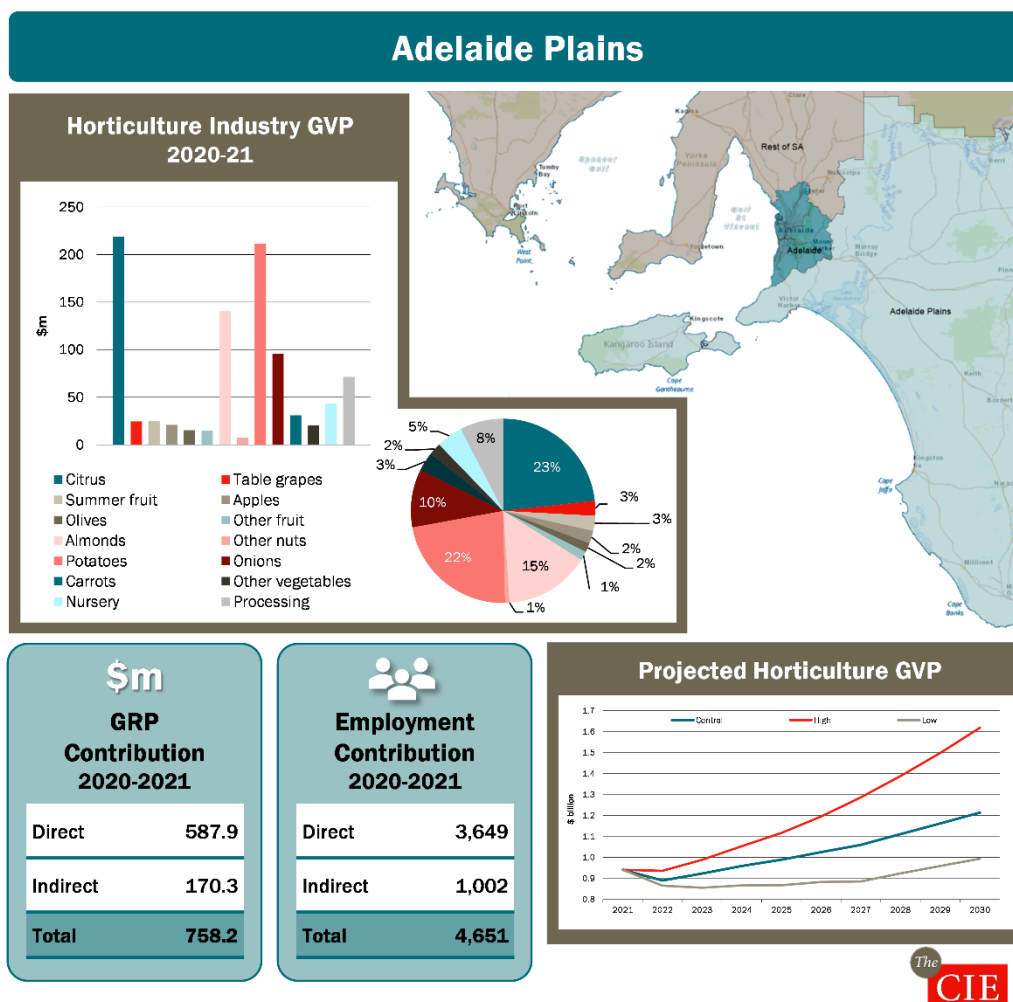
Cairns – Mareeba region



- The total value of horticulture industry was \$863 million in 2020-21, with a value added of \$515 million (3.2 per cent of GRP) and employment of 3 253 FTEs (2.8 per cent of regional employment).
- Bananas is the major horticultural commodity in the region, accounting for 60 per cent of total value of horticulture.
 - The region produces 86 per cent of the nation’s total banana production.
- The horticulture industry in the region contributed directly \$515 million to the GRP and induced another \$82.2 million in GRP in 2020-21.

- The direct employment of the industry was 3 253 FTEs, with another indirect employment of about 461 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 26 per cent to \$1 billion by 2029-30 under the Central scenario, with a range from \$941 million under the Low scenario to \$1.1 billion under the High scenario.
 - Future growth could be further enhanced if export market will be developed. Currently the horticulture sector in the region is dominated by banana production which is virtually fully for domestic consumption, limiting future growth.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$650-749 million by 2029-30 while total employment contribution to be 3 780 to 4 210 FTEs.

Adelaide Plains region



- The total value of horticulture industry was \$941.5 million in 2020-21, with a value added of \$587.9 million (5.2 per cent of GRP) and employment of 3 649 FTEs (4.5 per cent of regional employment).

- Citrus, potatoes, and almonds are the major horticultural commodities in the region, accounting for 23.2 per cent, 22.5 per cent, and 15 per cent, respectively, of the region's horticulture GVP.
 - Onion is also significant, accounting for 10.2 per cent of the region's horticulture GVP, and the region produces almost half of the nation's total onion production.
- The horticulture industry in the region contributed directly \$587.9 million to the GRP and induced another \$170.3 million in GRP in 2020-21.
- The direct employment of the industry was 3 649 FTEs, with another indirect employment of about 1 002 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 29 per cent to \$1.2 billion by 2029-30 under the Central scenario, with a range from \$1.0 billion under the Low scenario to \$1.6 billion under the High scenario.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$795 million to 1.3 billion by 2029-30 while total employment contribution to be 4 683 to 7 129 FTEs.

1 Introduction

Background

Horticulture is an important industry with a farm gate value of \$15.25 billion in 2020-21⁵. The horticulture growing industry employs about 64 650 full-time equivalent (FTE) people and have a value added of \$9.6 billion.

Including processing of horticultural products, the industry has a gross value of product (GVP) at \$17.8 billion, employs about 69 700 FTEs and generates value added of around \$10.2 billion.

To support the horticulture industry understand broader contribution to national and regional economies presently and in the future, the Centre for International Economics (CIE) was commissioned by Hort Innovation to undertake the analysis. More specifically the study includes the following three major tasks:

- estimating the current and future contributions of the horticulture industry to the national, state and regional economies
- projection of the horticulture industry up to 2030;⁶ and
- a broad regional analysis with detailed case studies in four key horticulture regions (Cairns – Mareeba region in Queensland, Coffs Harbour – Grafton region in New South Wales, Mildura region in Victoria and Adelaide Plains in South Australia).

The study involves comprehensive data and modelling analysis with detailed horticulture commodity coverage.

Measuring economic activity

The most obvious measurement of economic activity is the output that a farm or a factory produces – **quantity** or **volume** of production, such as tonnes of apples produced.

As suggested by the idiom ‘comparing apples and oranges’, however, products are different, and thus their quantities are not comparable and addible. To overcome this issue, production is measured in dollar values, called **gross value of production (GVP)**, which is the quantity of output multiplying by price.

⁵ Hort Innovation 2022, *Australian Horticulture Statistics Handbook 2020/21*, February 2022, available at <https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/grower-resources/ha18002-assets/australian-horticulture-statistics-handbook/>

⁶ Year in this report refers to financial year ending 30 June of the corresponding year, for example 2030 means financial year 2029-30.

Following the convention of the *Australian Horticulture Statistics Handbook*, farm gate or factory gate prices are used to calculate the GVPs in this report, which is equivalent to local value reported in the *Value of Agricultural Commodities Produced, Australia* data series published by Australian Bureau of Statistics (ABS)⁷. ABS also reports gross value, which is local value plus transport and marketing costs.

To produce a commodity, a farm or a factory has to use inputs in the production process. Inputs can be categorised as **intermediate inputs** and **production factors** (or **primary factors**). Intermediate inputs, such as energy, fertiliser, pesticides, are goods or services produced in other processes and may be either transformed or used up by the production process.

By contrast, production factors, including labour, land or natural resource, capital and entrepreneurship, are not used up by the production process – only the flow of services from these factors enters into the production. The services produced by these primary factors add value to costs of intermediate inputs in the produced commodity. That is why the value of these services or returns to the primary factors is called **value added**.

Corresponding to the primary factors, value added include wage (compensation to labour), rent (return to land and natural resources), and profit (return to capital and entrepreneurship).

In sum, GVP equals to the sum of intermediate input costs and value added.

As value added measures the new value generated in a production process, it presents a better measurement of economic activity to avoid double counting when multiple products or sectors are involved. For example, producing apple juice uses apples as ingredients (an intermediate input). Adding GVPs of apples and apple juice would overstate the actual size of economic activities by counting the value of apples twice. By contrast, adding value added in each production process or sector counts only the new value generated during production.

Gross value added (GVA) is the sum of value added from all industries within an economy. GVA is the major component (over 93 per cent according to the latest Australian input-output table published by ABS) of the gross domestic product (GDP), gross state product (GSP) or gross regional product (GRP). The balance of GDP (or GSP/GRP) is net taxes (taxes net of subsidies) in production and final consumption.

As a part of the value added, **employment** is also a measure of economic activity. Due to variations in the length of working hours, employment is often reported as full-time equivalent (FTE).

Contribution of an industry to the economy

Measuring the contribution of a whole industry to the economy is a challenging task in economic analysis.

⁷ <https://www.abs.gov.au/statistics/industry/agriculture/value-agricultural-commodities-produced-australia/2020-21>

Under the System of National Accounts (NSA),⁸ the contribution of one industry to the economy is measured by the value added (income or return to production factors as mentioned above), that is its share in the GDP, GSP or GRP.

It is argued that the existence of an industry would induce additional economic activities due to higher demand for inputs into the industry and higher income generated by the industry. This is especially true for regional economy where resources could be drawn from outside to boost local activities. In this sense, the contribution of an industry should include this induced, or indirect effects.

There are, however, counter arguments. First, the boost in economic activities in one region or sector may mean a contraction in other places because of movement of limited resources. As a result, the induced effects may be reduced when looking at a broader scope. If the induced, indirect contribution is included for every industry, the whole economy would be much bigger than its actual size, presenting serious double counting problem.

Second, it is argued that the ‘true’ contribution of an industry should be measured by the difference to its next best use of resources. For example, most horticulture is irrigation farming, and its contribution could be measured against the value added from rice and other irrigation crops, or even dryland agriculture. In any case, the contribution an industry brings into the economy would be smaller, rather than larger, than the industrial value added, if measured in this way.

Third, difficulties and controversies arise from the requirement that the contributions should be measured with a counterfactual situation where the evaluated industry does not exist, which is difficult, if not impossible, to establish. As the economy has been highly integrated, disappearance of one industry, taking the energy sector as an example, may lead to collapse of the whole economy, at least in the short term.

In sum, the induced, indirect contribution is a theoretical measurement of additional contribution that an industry may make, acknowledging the interlinkages between industries, and is better interpreted at the margin. Caution should therefore be taken not to overstate it.

The traditional input-output multipliers tend to overstate the contributions enormously. This overstatement is due to the limitation of input-output modelling which ignores the resources constraints and lacks price signals to adjust the supply and demand. For this reason, many organisations have stopped using multipliers coming out from input-output modelling. For example, ABS has stopped publishing the input-output multipliers since the 1998-99 issue of *Australian National Accounts: Input-Output Tables*, citing “they are based on limiting assumptions that results in multipliers being a biased estimator of the benefits or costs of a project”.⁹

⁸ European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank 2009, *System of National Accounts 2008*, United Nations, New York.

⁹ ABS 2022, *Australian National Accounts: Input-Output Tables*, <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-input-output-tables/latest-release>

We used a general equilibrium modelling framework to estimate the contribution of the horticulture industry because it overcomes the limitations of the input-output modelling. More details will be provided in the next chapter on methodology.

The difficulty and complexity would amplify when estimating the future contributions of an industry because there are significant uncertainties associated with the outlook of the industry and the wider economy. We will consider the uncertainties with carefully constructed scenarios and clearly state the relevant assumptions.

This report

The remainder of this report is structured as follows:

- the next chapter introduces the CIE's approach to conduct the analysis including brief descriptions of the models, commodity and regional classification and data sources;
- chapter 3 reports the current status of the horticulture industry and its contributions to the economy;
- chapter 4 provides the outlook for the industry up to 2030 including key assumptions for the projection;
- chapter 5 discusses the horticulture industry in 4 case study regions and its contribution to the regional economy;
- appendix A introduces the models used for this study; and
- appendix B provides details about the assumptions used for industry outlooks.

Complementing to this report, a dataset of regional horticulture industry production value, value added and employment from 2021 to 2030 is also provided.

2 Methodology

The CIE uses a comprehensive modelling framework with detailed data analysis and stakeholder consultations to estimate the current and future contributions of the horticulture industry to national, state and regional economies.

A general equilibrium modelling framework

Traditionally, estimating contributions has been through the input-output modelling with input-output (I/O) multipliers. It is commonly used to estimate the contributions of small industries, where the focus of contributions is often regional or sub-regional. Regionally, inputs such as labour are often relatively mobile and thus the limitations of input-output are less salient. However, input-output modelling is considered inadequate for a large industry, which have capacity to affect the broader state or national economy.

There has been increasing awareness of the limitations and inappropriateness of these approaches. For example, the Australian Bureau of Statistics (ABS) stopped publishing the I/O multipliers since the 1998-99 issue of Australian input-output tables.

In particular, the input-output analysis involves several key assumptions which limit its suitability for analysing large-scale projects or industries, including:

- no change in technology or labour productivity;
- fixed import shares;
- unlimited input factors such as labour, capital, land and natural resources; and
- fixed prices.

Importantly, these assumptions mean that input-output analysis does not consider the trade-off of resources such as capital and labour which occurs as a result of the movement of these inputs from other areas of the economy to the project. As a result, the economic impacts estimated through input-output modelling are often overstated:¹⁰

Abuse primarily relates to overstating the economic importance of specific sectoral or regional activities. It is likely that if all such analyses were to be aggregated, they would sum to much more than the total for the Australian economy. Claims that jobs 'gained' directly from the cause being promoted will lead to cascading gains in the wider economy often fail to give any consideration to the restrictive nature of the assumptions required for input-output multiplier exercises to be valid. In particular, these applications fail to consider the opportunity cost of both spending measures and alternate uses of resources, and may misinform policy-makers.

¹⁰ Gretton, Paul 2013, *On input-output tables: uses and abuse*, Staff Research Note, September, Productivity Commission, Canberra, p1, available at <https://www.pc.gov.au/research/supporting/input-output-tables>

As such, a general equilibrium modelling framework is more appropriate to estimate the contribution of the horticulture industry. Computable general equilibrium (CGE) modelling is able to overcome the above mentioned limitations by allowing for supply restrictions and price movements such that the trade-off of resources is inherent within the model. This enables a more accurate estimation of the economic impacts.

Further, as the industries and sectors in a CGE model are interlinked, it is easy to track the impact of an industry through the whole value chain, from upstream suppliers to the industry through to the downstream users.

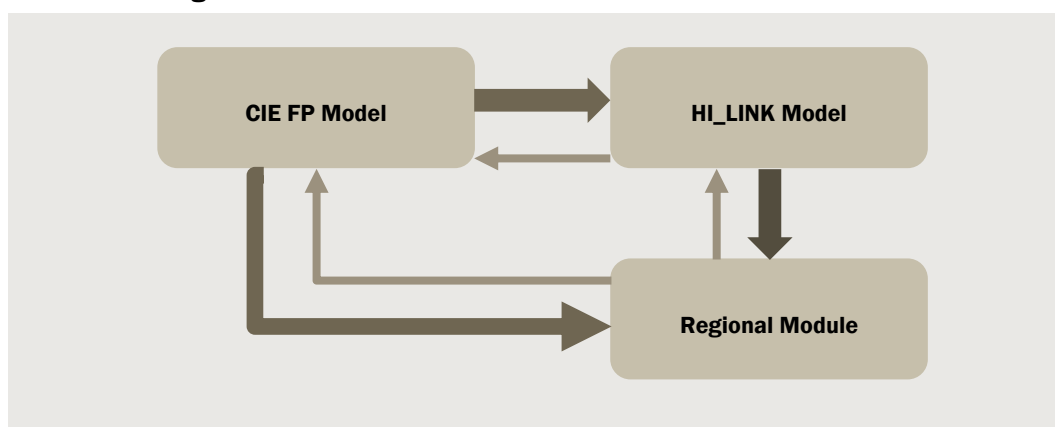
Second, different underlying factors have different impacts on the wider economy although they may end up with the same growth in the interested industry. In general industrial growth resulted from productivity improvement generates more economic benefit to the whole economy than that from a demand increase. This is because the productivity improvement leads to more efficient use of inputs to produce certain amount of outputs and thus free up valuable resources to expand the interested industry and/or other industries.

Models used

Chart 2.1 illustrates the modelling framework for the analysis. It involves three models/modules:

- FP model – a general equilibrium model of the Australian economies with a detailed identification of farming and food processing industries in 8 states and territories;
- HI_LINK model – a detailed horticulture value chain model identifies 42 horticulture growing (farming) and 6 horticulture processing commodities/sectors; and
- Regional Module – a model with detailed regional economic structure to estimate the regional impacts in accordance with the national and state-level results.

2.1 Modelling framework



Data source: CIE

These models are interlinked so that they use results of other models as inputs while providing feedbacks to other models, while the main information flow is from FP and HI_LINK to Regional Module.

FP model

The CIE FP model is a special version of the CIE's original inhouse CGE model of the Australian economies, CIE-REGIONS.

For the FP model, considerable effort was put into restructuring the commodities and sectors in the original CIE-REGIONS model. More specifically, the previous broad on-farm sectors are split into 10 more specific ones, and the single food, beverage and tobacco sector in the original version is split into 11 more specific food processing sectors. Consequently, other manufacturing and services sectors are aggregated.

With this detailed treatment of farming and food processing industries, the model is able to evaluate the changes, e.g. productivity improvement and/or demand preference shift induced by R&D and policy interventions, at any point of the food value chain from growing to processing, wholesale, export and retail.

Despite the difference in sectoral classification, the other properties of the FP model are the same as the CIE-REGIONS model. In particular, the model has a general equilibrium framework to capture the inter-links between industries, between production and consumption, and between domestic and international markets.

The model can be run in a static or dynamic mode. The dynamic mode allows analysis to trace impacts over time as the economy adjusts, being particularly useful for producing projections over the medium to longer periods.

Details about the model are provided in appendix A.

HI_LINK model

While the CIE FP model has a fairly detailed representation of the farming and food processing industries in Australia, its sectoral classification for horticulture may be still highly aggregated. To supplement the CIE FP model, we used a detailed horticultural industry value chain model, HI_LINK, which was initially developed by the CIE for Hort Innovation in 2008 for the development of horticultural industry strategy.

The HI_LINK model is an economic model of the entire horticulture industry. It distinguishes 48 commodities covering fresh, processed and amenity horticulture. It has a value-chain for each of these commodities from farm gate through to processing, wholesale, retail and export. Both supply and demand (including domestic and international demand) are considered in the model.

Details about the model are provided in appendix A.

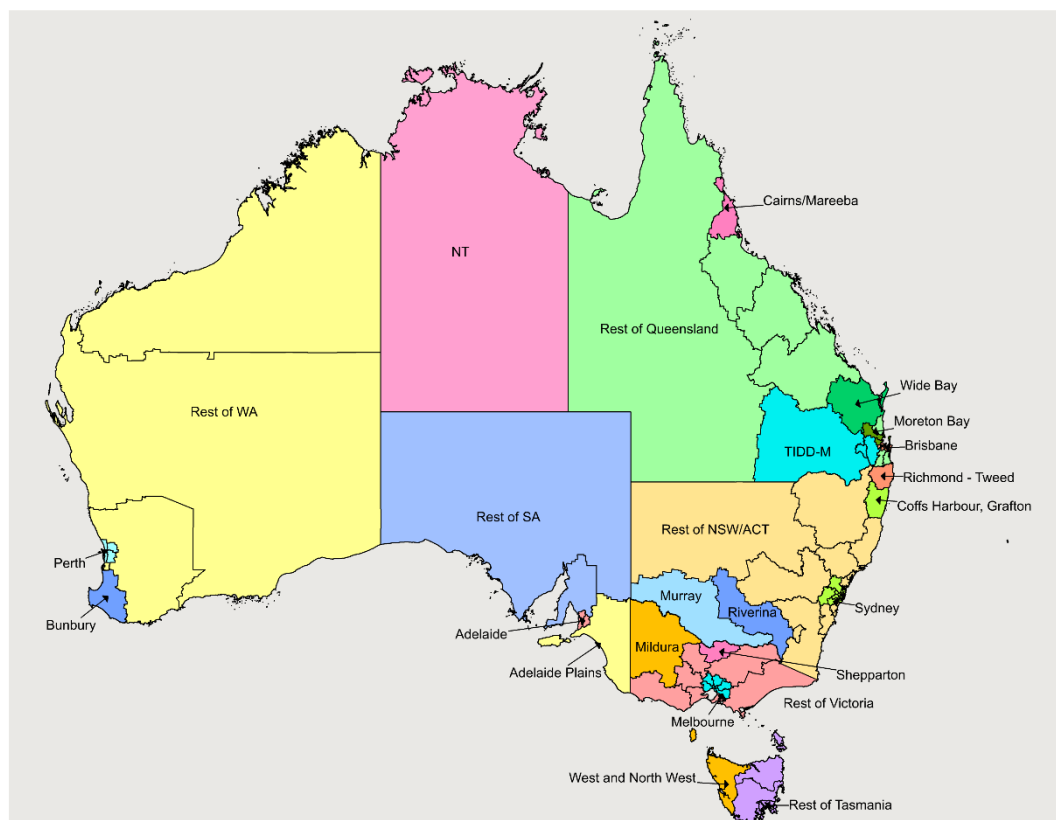
Regional module

The regional module projects the national and state level results into regional levels. The module has equivalent sector classification as the FP model and HI_LINK model with more detailed regional coverage.

A total of 25 horticulture regions were identified, reflecting the concentration of horticulture industry (chart 2.2). The classification of these regions is based on the ABS

Statistical Area Level 4 (SA4), such that regional results can sum up to state results and then to national results.

2.2 Horticulture regions for the analysis



Note: TIDD-M: Toowoomba, Ipswich, Darling Downs - Maranoa

Data source: CIE

Four regions are chosen for case studies:

- Coffs Harbour, Grafton (104 Coffs Harbour – Grafton) in NSW;
- Mildura (215 North West) in Victoria;
- Cairns/Mareeba (306 Cairns) in Queensland; and
- Adelaide Plains (407 South Australia – South East).

Details about the module are provided in appendix A.

Data sources

This study consults data and information from a wide range of sources, including

- Horticulture production and value data from Hort Innovation;
- agricultural commodities and other statistics from the Australian Bureau of Statistics (ABS);
- international outlooks from organisations such as the International Monetary Fund (IMF) and International Energy Agency (IEA); and

- statistics and outlooks from other Australian organisations such as the Reserve Bank of Australia (RBA), the Australian Bureau of Agricultural Economics and Sciences (ABARES) and the Office of Chief Economist (OCE) at the Department of Industry, Science, Energy and Resources.

Australian Horticulture Statistics Handbook

Hort Innovation has been publishing *Australian Horticulture Statistics Handbook* (AHSB) series with detailed data on production, processing, export, import and supply for over 70 horticulture commodities (see the list in table A.5). AHSB data are provided to the CIE in electronic forms for 9 years from 2012-13 to 2020-21. It is noted that some entries in the electronic version are different from the hard copy publications due to ongoing updates.

The handbook provides state fresh supply data which has been used in this study to allocate national production into states and territories with the assumption that the farm gate prices are the same across states and territories for a specific commodity. These state/territory data are then broken down into regional data using information from ABS and other sources (see below).

ABS data

ABS publishes data on value of agricultural commodities at SA4 region (Cat.No.7503.0). This data distinguishes between local value (farm gate value) and gross value (value at the point when ownership of the commodity is relinquished by the agriculture industry, usually including farm gate value, marketing and transport cost). The local value in the ABS data is used to breakdown the AHSB state level data into the horticulture regions based on SA4s. ABS data has reasonable coverage of horticultural commodities although the classification changes over time. The latest statistics (data for 2020-21 released in late July 2022) are used for the breakdown for a commodity if it is defined in the ABS data or for the control of a broad category with further reference to earlier statistics that have detailed classification.

ABS Census 2021 and labour force data provide detailed employment hours by industries and labour force situation at the SA4 level. Combined with other data such as national and state accounts, labour force and industries, they are used to estimate the regional horticultural processing and other industries as well as regional employment by industries.

Other ABS data such as price indices, productivity estimates and population projections are also used to inform the development of projection assumptions.

Other data sources

Other major data sources include:

- *World Economic Outlook* (WEO) by the International Monetary Fund (IMF);¹¹
- World energy market outlook by the International Energy Agency (IEA)¹² and the US Energy Information Administration (EIA)¹³;
- Exchange rate and commodity prices data from Reserve Bank of Australia (RBA);¹⁴
- Agricultural outlooks and productivity estimates by ABARES;¹⁵ and
- Resources and energy outlook, *Resources and Energy Quarterly*, by the Office of Chief Economist (OCE) at the Department of Industry, Science, Energy and Resources¹⁶

Stakeholder consultation

A series of consultations were conducted to

- gain insights into the horticulture industry, especially regional characteristics, challenges and opportunities;
- test the CIE's initial estimates of the industry and contributions; and
- seek further comments on the case study candidates and additional information sources.

Stakeholder consultations were undertaken following the preparation of the quantitative material and initial modelling for this report. Stakeholders consulted include:

- Michael Rogers and Claire McClelland, Australian Fresh Produce Alliance (AFPA)
- Tyson Cattle, NFF Horticulture Council and AUSVEG
- Richard Shannon, GrowCom
- Bill Johnston and Brittany James, Queensland Department of Agriculture and Fisheries (DAF)
- Lesley Shield, Australian Horticultural Exporters' and Importers' Association (AHEIA)
- Cameron Carter, Seeka Australia
- Nathan Hancock and David Daniels, Citrus Australia

Consultations were conducted through videoconferencing. Stakeholders have discussed a range of issues affecting the growth of the horticulture industry, most imminently

- labour shortage and input costs;
- alternative market development;

¹¹ <https://www.imf.org/en/Publications/WEO/Issues/2022/07/26/world-economic-outlook-update-july-2022>

¹² <https://www.iea.org/topics/world-energy-outlook>

¹³ <https://www.eia.gov/outlooks/aeo/>

¹⁴ <https://www.rba.gov.au/statistics/frequency/exchange-rates.html> and <https://www.rba.gov.au/statistics/frequency/commodity-prices/2022/>

¹⁵ <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook/data>

¹⁶ <https://www.energy.gov.au/publications/australian-energy-update-2021>

- investment in infrastructure and the industry;
- R&D and extension; and
- data and information gathering and sharing.

Stakeholders have suggested a number of scenarios for modelling and case studies which are provided in Chapters 4 and 5 of this report.

3 Horticulture industry in Australia

National summary

Table 3.1 reports the modelling results for the national horticulture production value, value added and employment totals in 2020-21 by commodity.

3.1 National horticulture production, value added and employment in 2020-21

	GVP	Value added	Employment
	\$m	\$m	FTE
Fruit			
Apples	619.9	484.1	1,818
Pears and nashis	144.9	113.1	425
Summer fruit	338.9	231.0	701
Cherries	231.3	203.7	478
Strawberries	417.2	247.3	2,324
Rubus	644.1	563.3	3,587
Kiwi fruit	24.4	16.8	157
Oranges	437.6	308.8	1,604
Mandarins	341.9	259.8	1,253
Other citrus	156.8	125.8	575
Grapes - Table and Other	631.8	392.6	3,226
Grapes - Total Dried	25.3	15.7	129
Other temperate fruit	23.6	16.8	88
Bananas	596.8	360.8	2,225
Pineapples	46.8	25.7	174
Avocados	488.7	268.4	1,822
Mangoes	167.4	92.0	624
Melons	149.0	71.7	674
Other tropical fruit	104.7	57.5	390
Olives	161.2	131.1	642
Fruit sub-total	5,752.3	3,985.9	22,916
Nuts			
Macadamia	339.1	223.9	1,264
Almonds	721.6	549.6	2,690
Other nuts	135.5	104.6	505
Nuts sub-total	1,196.2	878.1	4,460

	GVP	Value added	Employment
	\$m	\$m	FTE
Vegetables			
Potatoes	807.3	480.2	3,651
Carrots	256.0	125.5	1,158
Onions	203.2	105.7	919
Pumpkins	89.4	40.2	404
Sweet corn	117.1	54.5	530
Peas and beans	143.5	103.4	649
Lettuce	171.9	67.5	777
Broccoli	258.9	126.0	1,171
Cauliflower	63.1	32.9	285
Capsicums; Chillies & Peppers	206.4	105.9	933
Tomatoes - processing	36.1	24.7	163
Tomatoes - fresh	526.1	244.8	2,379
Asparagus	81.1	71.3	367
Mushrooms	393.1	211.6	2,832
Garlic and herbs	259.2	155.5	1,172
Other vegetables	1,301.4	611.3	5,886
Vegetables sub-total	4,913.8	2,561.0	23,277
Nursery and other			
Nursery	2,789.5	1,805.0	9,983
Cultivated turf	308.0	216.5	1,333
Cut flowers	290.2	164.8	2,677
Nursery and other subtotal	3,387.7	2,186.2	13,993
Total farming	15,250.0	9,611.3	64,646
Processing			
Frozen potatoes	652.4	148.5	1,371
Canned tomatoes	243.3	55.4	511
Other processed vegetables	350.0	79.7	736
Processed fruits and jams	529.9	120.6	1,114
Orange and other juice	576.2	131.2	1,211
Olive oil	206.3	11.7	108
Processing subtotal	2,558.1	547.1	5,051
Total horticulture	17,808.1	10,158.3	69,697

Source: CIE estimates based on Australian Horticultural Statistics Handbook and ABS data

The gross value of production (GVP) for horticulture growing is aligned with the value in Australian Horticulture Statistics Handbook (AHSH) except for cut flowers production in SA and Tasmania, which is different to the ABS statistics.

AHSH does not report any cut flower production in SA and Tasmania, while ABS reported more than \$5 million of cut flowers production each in SA and Tasmania in

2020-21.¹⁷ According to ABS, SA and Tasmania has been producing cut flowers for last few years. More specifically, cut flowers production in SA grew from \$3-4 million to the current level, while the production in Tasmania fell from \$11-12 million to the current level. It is therefore reasonable to include some cut flowers production in SA and Tasmania.

Using the relativeness of production value of cut flowers in SA and Tasmania against the value of the largest cut flower producer – Victoria – in the latest ABS statistics, it is estimated that the GVP of cut flowers in SA and Tasmania is \$6.28 million and \$6.66 million respectively.

As such, the GVP of horticulture farming in this study is \$15.250 billion, \$12.93 million higher than the value of \$15.237 billion in the Handbook.¹⁸

Horticulture related processing produced a further \$2.56 billion, leading to a total GVP of \$17.8 billion for the whole horticulture industry in Australia in 2020-21.

Horticulture farming has a high value added (factor income of labour, capital and land) share, about 63 per cent on average, which is higher than the average value added share of 50 per cent for all industries according to the latest input-output table published by ABS¹⁹. The total value added of horticulture farming is estimated to be \$9.6 billion for the year 2020-21.

On the other hand, processing has high intermediate inputs, and thus having a low value added share at 21 per cent on average, compared to 63 per cent share for horticultural farming and the economywide average of 50 per cent as discussed above. The value added of horticulture processing is estimated to be \$547 million.

It is estimated that the whole horticulture industry employed 69 700 full-time equivalent (FTE) persons in total, with 64 650 FTEs in farming and another 5 050 FTEs in processing, for the year 2020-21.

Regional summary

Table 3.2 reports regional gross value of product (GVP), value added and employment in the horticulture industry including processing.

Among the 25 regions nationally, North West (Mildura) region in Victoria is the most valuable region with a GVP of \$1.69 billion, a value added of \$1.07 billion and employs more than 6 930 FTEs. Melbourne is the second largest region in horticulture growing

¹⁷ ABS 2022, *Value of Agricultural Commodities Produced, Australia*, Cate.No.7503.0, available at <https://www.abs.gov.au/statistics/industry/agriculture/value-agricultural-commodities-produced-australia/latest-release#data-download>

¹⁸ The spreadsheet provided by Hort Innovation has a total value of horticulture production of \$15 237.1 million in 2020-21, which is slightly different to the value of \$12 236.6 million in the hard copy publication.

¹⁹ ABS 2022, *Australian National Accounts: Input-Output Tables*, Cate.No.5209.0.55.001, available at <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-input-output-tables/2019-20>

(especially vegetables) and processing, with a GVP of \$1.55 billion, a value added of \$841 million, and employment of about 6 530 FTEs. Rest of Queensland is the third largest region in horticulture growing and processing, with a GVP of \$1.31 billion, a value added of \$734 million and employment of 5 280 FTEs.

3.2 Regional horticulture industry summary

	GVP	Value added	Employment
	\$m	\$m	FTE
New South Wales and ACT			
Coffs Harbour - Grafton	441.4	348.8	2,262
Richmond - Tweed	371.5	238.6	1,439
Riverina	636.7	420.9	2,259
Murray	391.1	240.3	1,546
Sydney	1,057.1	465.0	3,841
Rest of NSW/ACT	687.0	424.3	2,678
NSW/ACT total	3,584.8	2,137.8	14,026
Victoria			
North West (Mildura)	1,689.5	1,074.5	6,932
Shepparton	1,221.9	644.1	3,769
Melbourne	1,546.7	840.7	6,531
Rest of Victoria	1,208.2	647.5	4,873
Victoria total	5,666.3	3,206.8	22,105
Queensland			
Cairns (Cairns/Mareeba)	862.7	515.0	3,253
Wide Bay	985.7	601.1	3,887
Moreton Bay	307.4	185.8	1,307
Brisbane	362.1	137.1	995
TIDD-M	911.1	453.4	3,655
Rest of Queensland	1,313.0	734.1	5,282
Queensland total	4,741.8	2,626.5	18,378
South Australia			
South Australia - South East (Adelaide Plains)	941.5	587.9	3,649
Adelaide	562.5	277.0	2,170
Rest of SA	82.2	39.2	390
SA total	1,586.2	904.2	6,209
Western Australia			
Perth	412.7	220.5	1,662
Bunbury	405.6	229.4	1,520
Rest of WA	343.1	187.3	1,441
WA total	1,161.4	637.3	4,623

	GVP	Value added	Employment
	\$m	\$m	FTE
Tasmania			
West and North West	346.9	203.6	1,500
Rest of Tasmania	540.2	341.0	2,154
Tasmania total	887.1	544.7	3,654
Northern Territory			
NT	180.5	101.2	702
Australia	17,808.1	10,158.3	69,697

Note: data for 2020-21; TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE estimates

Shepparton in Victoria is the fourth largest horticulture region in terms of GVP (\$1.22 billion). It is followed by Rest of Victoria (\$1.21 billion), Sydney (\$1.06 billion), Wide Bay region in Queensland (\$986 million), South East (Adelaide Plains) region in South Australia (\$942 million), Toowoomba, Ipswich, Darling Downs – Maranoa (TIDD-M) region in Queensland (\$911 million), and Cairns/Mareeba (\$863 million).

Greater Melbourne and Sydney are among the top 10 horticulture regions because they have a relatively significant horticulture processing industry, vegetable sector and amenity horticulture including nursery, cultivated turf and cut flowers that serve the urban population. For example, Sydney produces \$493 million of processed horticultural products, accounting for 43 per cent of its horticultural GVP, with another \$339 million (32 per cent) from nursery, cultivated turf and cut flowers, and \$257 million (24 per cent) from vegetables including about \$113 million of mushrooms growing.

These top 10 regions account for about two thirds of the nation's horticulture growing and processing GVP, value added and employment.

Chart 3.3 illustrates the broad structure (share of production value) of the horticulture industry for each of the 25 regions. It can be seen from the chart that there are significant differences across regions even from the broad category.

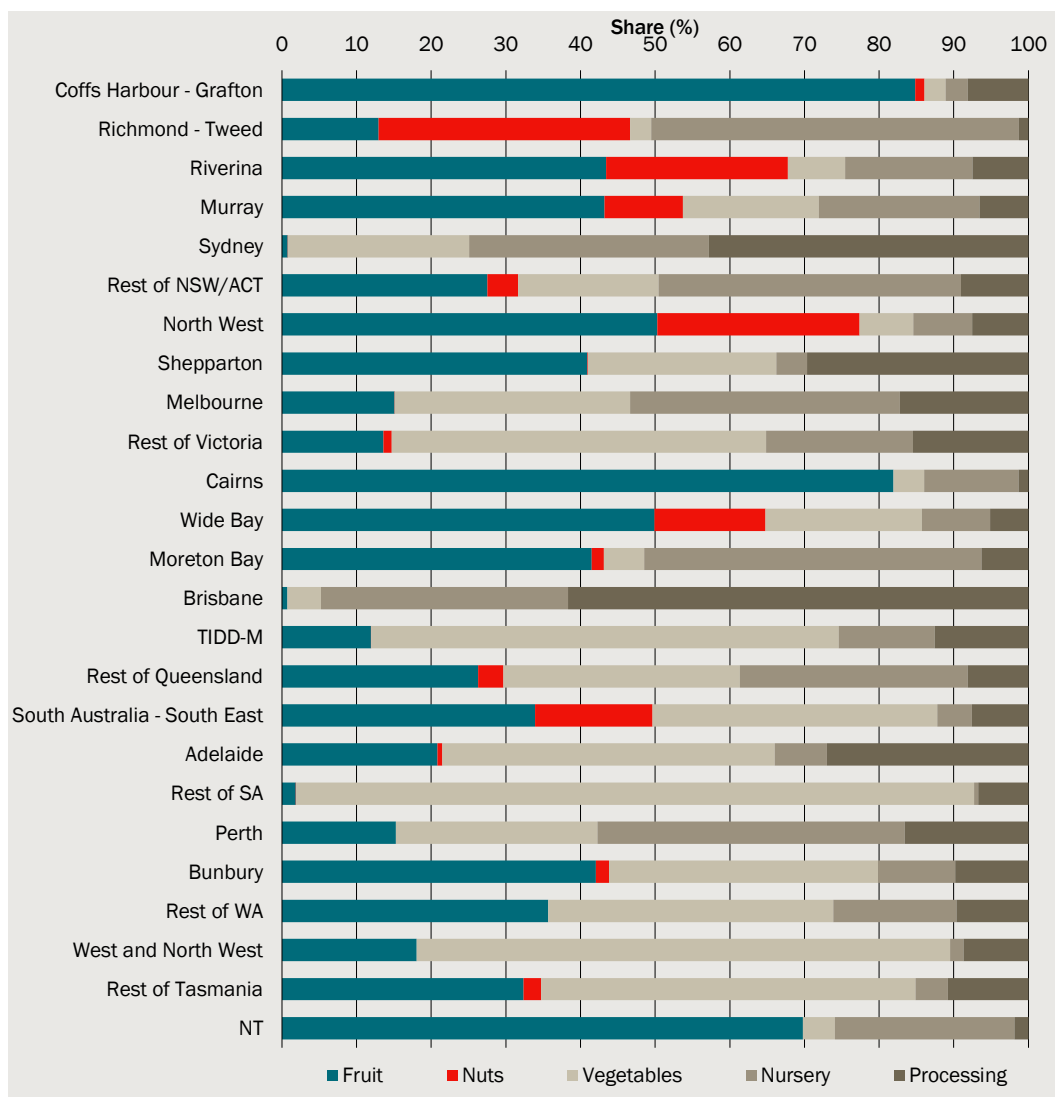
Coffs Harbour – Grafton region has the highest share of fruit production, accounting for 84.9 per cent of the region's total horticulture production value including processing. It is immediately followed by Cairns with a share of 81.9 per cent. Northern Territory as a whole ranks the third with a share of 69.8 per cent.

Other regions with a high share of fruit production include North West (Mildura) region in Victoria (50.3 per cent), Wide Bay region in Queensland (49.9 per cent), Riverina region in New South Wales (43.4 per cent), Murray region in New South Wales (43.2 per cent), Bunbury region in WA (42.1 per cent), Moreton Bay region in Queensland (41.5 per cent) and Shepparton region in Victoria (40.9 per cent).

Richmond – Tweed region in NSW has the highest share of nuts, accounting for 33.7 per cent of the region's total horticulture production including processing. It is followed by North West (Mildura) region in Victoria with a nut share of 27.1 per cent, Riverina

region in NSW (24.3 per cent), South East (Adelaide Plains) region in South Australia (15.7 per cent), Wide Bay region (14.9 per cent) and Murray region (10.5 per cent).

3.3 Regional horticulture sector structure



Note: share in the regional total horticulture production value in 2020-21; TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa
Data source: CIE

Rest of South Australia has the highest share of vegetable production (90.8 per cent of total horticultural production). It should be noted that the region has a very small horticulture production value of \$82.2 million. The high concentration in vegetables production is due to the fact that most vegetables are consumed fresh and thus serve the local population.

West and North West region in Tasmania has the second highest vegetable share, accounting for 71.5 per cent of total regional horticulture production value. It is followed by Toowoomba, Ipswich, Darling Downs – Maranoa (TIDD-M) region (62.6 per cent), rest of Victoria (50.2 per cent), Rest of Tasmania (50.1 per cent), Adelaide (44.5 per cent), Rest of WA (38.2 per cent), South East (Adelaide Plains) region in SA (38.1 per cent),

Bunbury region in WA (36.0 per cent), Rest of Queensland (31.7 per cent) and Melbourne (31.1 per cent).

As mentioned above, this pattern of vegetable production – high share in country regions and some metropolitan regions – reflects the nature that most vegetables are consumed fresh and have low export share and thus require growing close to population base.

Richmond – Tweed has the highest share of nursery, cut flowers and turf, accounting for 49.2 per cent of the region's total horticulture production value. It is followed by Moreton Bay (45.2 per cent), Perth (41.2 per cent), the Rest of NSW/ACT region (40.5 per cent), Melbourne (36.2 per cent), Brisbane (33.1 per cent) and Sydney (32.1 per cent). This pattern also reflects the fact that the nursery sector needs to be close to the population centres.

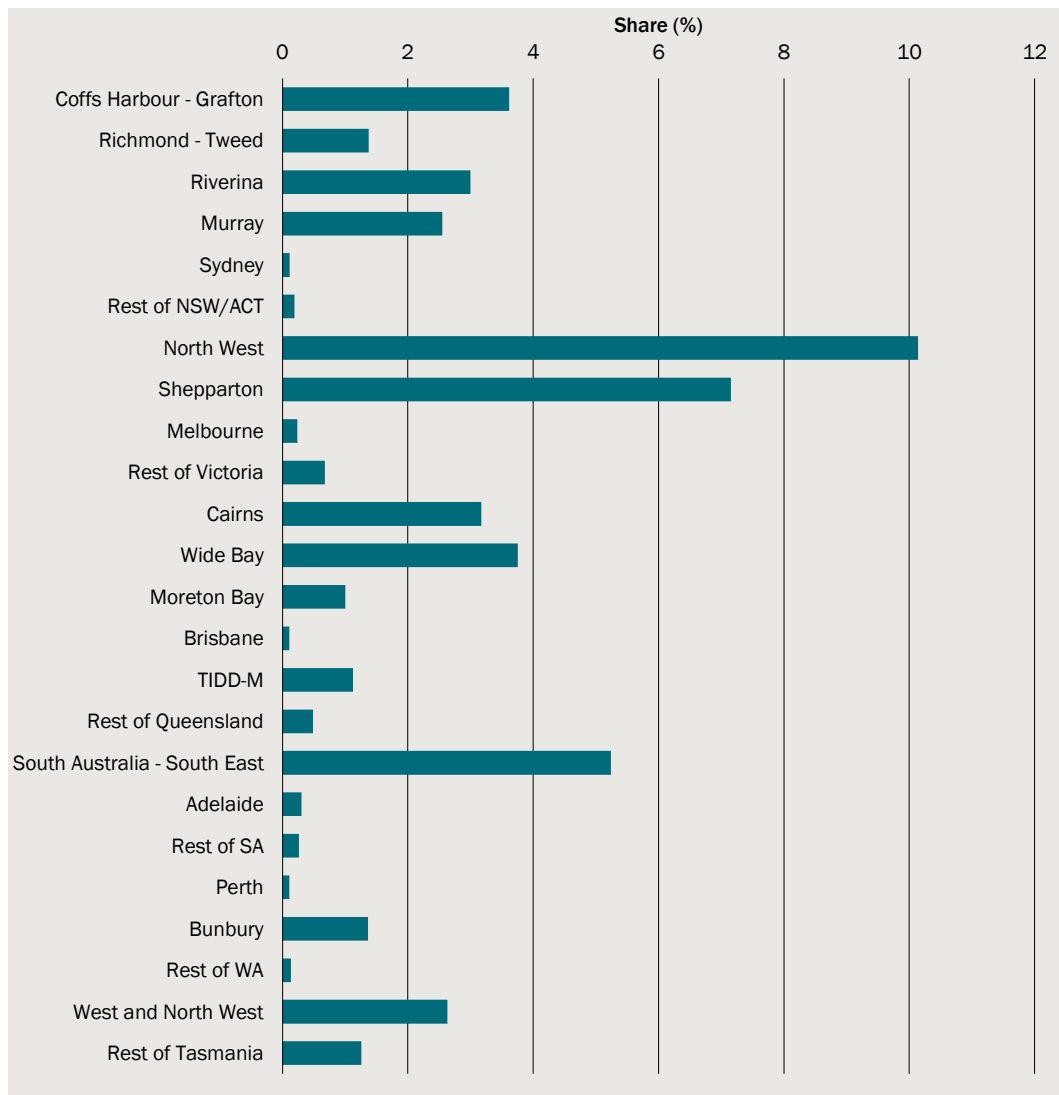
As a manufacturing sector, the horticulture processing sector sees high concentration in metropolitan regions. For example, Brisbane has the highest share of horticulture processing, accounting for 61.7 per cent of total horticulture production value, followed by Sydney (42.8 per cent), Shepparton (29.6 per cent), Adelaide (27.0 per cent), Melbourne (17.2 per cent) and Perth (16.6 per cent). The high share of processing in metropolitan regions also reflects the fact that these regions have relatively low share of horticulture farming activities.

Importance of horticulture in the economy

Chart 3.4 reports the share of horticultural gross value added (GVA) in each region's gross regional product (GRP).

North West (Mildura) region in Victoria has the highest share of horticulture, accounting for 10.1 per cent of GRP. It is followed by Shepparton with a horticulture share of 7.2 per cent, South East (Adelaide Plains) region in SA (5.2 per cent), Wide Bay region in Queensland (3.8 per cent), Coffs Harbour – Grafton region in NSW (3.6 per cent), Cairns/Mareeba region in Queensland (3.2 per cent) and Riverina region in NSW (3.0 per cent).

3.4 Horticulture share in GRP

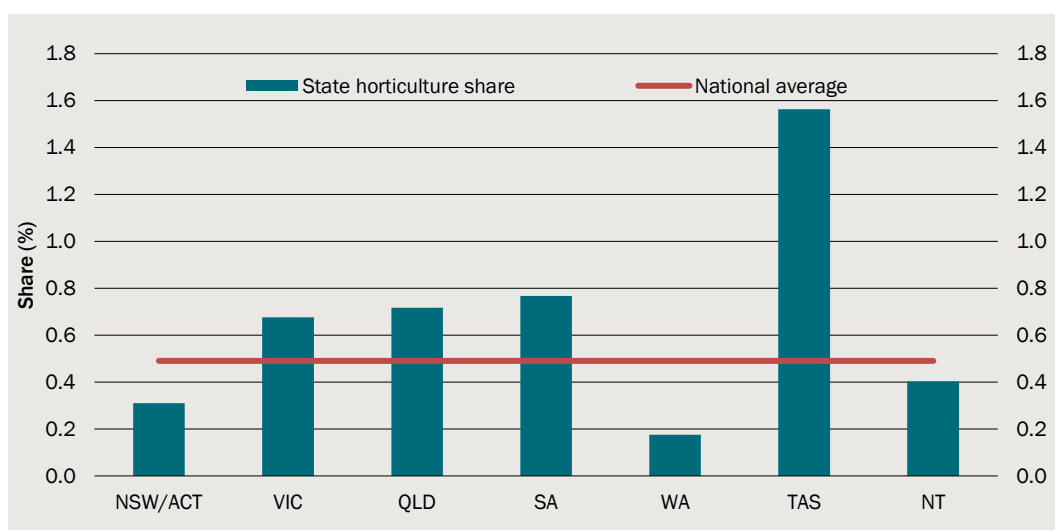


Note: data for 2020-21; TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Data source: CIE

State-wise, Tasmania has the highest share of horticulture in gross state product (GSP), accounting for 1.56 per cent. It is followed by SA with a share of 0.77 per cent, Queensland (0.72 per cent) and Victoria (0.68 per cent). Nationwide, the horticulture industry accounts for 0.49 per cent of gross domestic product (GDP) (chart 3.5).

3.5 Horticultural share in GSP and GDP



Note: data for 2020-21

Data source: CIE

Horticulture contribution to economy

How does the horticulture industry contribute to the economy

Table 3.6 illustrates the impacts of horticulture growing and processing on the factor income (value added) in other sectors.

3.6 Sectoral impacts of horticulture growing and processing

	Growing		Processing
	\$		\$
Horticulture growing	100.0	Horticulture processing	100.0
Other agriculture	-0.6	Horticulture	6.1
Mining	-0.8	Other agriculture	-1.8
Horticulture processing	5.0	Mining	-13.6
Other manufacturing	-4.1	Other manufacturing	-8.6
Utility	0.6	Utility	7.1
Construction	1.8	Construction	15.7
Trade (wholesale and retail)	12.1	Trade (wholesale and retail)	57.4
Transport	0.2	Transport	0.8
Other services	11.1	Other services	81.3
Total	125.2	Total	244.4

Source: CIE modelling

The growth in one industry has two opposite effects on other industries. The income effect, either through higher income or higher demand from the growing industry, will

see growth in other sectors. By contrast, the substitution effect, due to competition for limited materials and resources, will see contraction in other sectors. The final, equilibrium, impact depends on which effect dominates.

For example, other agriculture suffers a small contraction because (\$0.6 reduction in value added of other agriculture sector for every \$100 increase in the value added of horticulture growing) because the competition from horticulture growing for labour, land, water and other common inputs outweigh the income effect induced by higher horticultural growing. The value added in horticultural processing increases by \$5, reflecting the fact that a small share of horticulture commodities is processed and the value added share of processing is relatively low.

The small increase in value added of the utility sector reflects the high consumption due to income effects, while the increase in construction reflects higher investment as the economy grows.

Trade (which covers wholesale and retail trade) benefits the most from increase in horticulture growing because relatively high marketing requirements for horticultural commodities.

Other services sector is the second largest sector benefiting from horticulture growing because it is the largest sector in the economy and higher income leads to high demand for these services.

In sum, the net impact on other industries is \$25.2 as a result of \$100 increase in value added of the horticulture growing sector, leading to \$125.2 total contribution to the economy.

By contrast, the same amount increase in the value added of the horticulture processing sector has much higher induced, indirect, impacts (\$144.4). This is mainly due to two factors.

First, processing has much lower value added share (about 20 per cent on average) than growing (more than 60 per cent). This suggests that for the same amount of value added, the processing sector activity measured in gross value of production (GVP) would be much higher than growing, leading to higher induced impacts.

Second, because the processing sector faces less fixed factors (for example, land is not considered a constraint in processing as opposed to that in farming), and is thus easier to expand and to have dominating income effects with much less substitution effects.

However, as the processing sector accounts for a small share (about 14 per cent in GVP and 5.4 per cent in value added as shown in table 3.1 above) in the whole horticulture industry, the overall impact is dominated by the growing sector with low induced effects. As will be seen below, the share of induced, indirect impact of the whole horticulture industry is close to 25 per cent, the share of induced impact of the horticulture growing sector.

It is interesting to note that a small amount of domestic horticulture farming value added is induced by the higher activity level of processing. This is because the fresh horticulture ingredients account for a small share of the total processing production with some

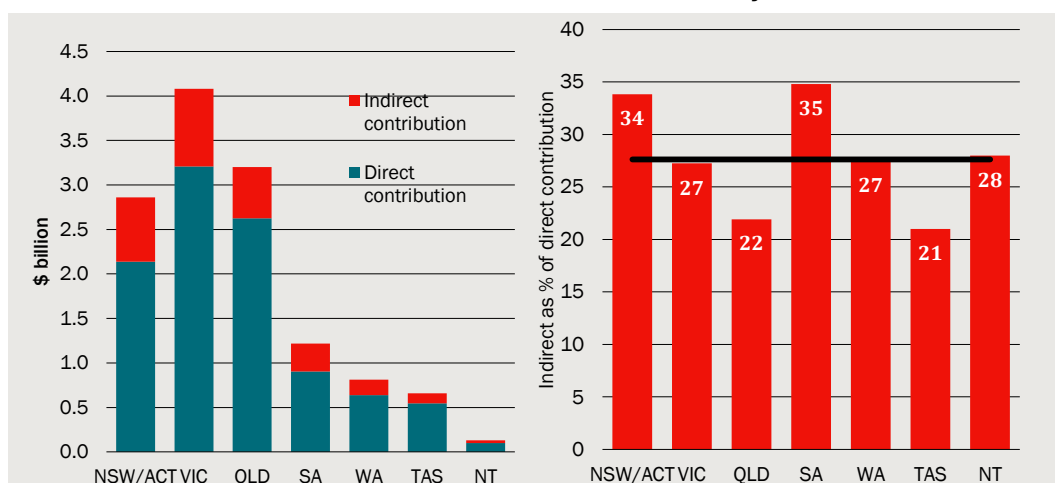
ingredients being low grades compared to direct domestic consumption and exports and some from imports.

Contribution to the state and national economy

It is estimated that the horticultural industry would make additional, indirect contribution to Australian economy by \$2.8 billion, leading to a total contribution of \$12.96 billion. This suggests that every dollar in horticultural value added contributes \$1.28 to the GDP.

The flow-on impact varies across states due to difference in horticultural commodities and the wider economic structure as discussed above. As shown in chart 3.7 (right panel), South Australia has the highest indirect contribution ratio, being about 35 per cent of the direct contribution, while Tasmania has the lowest indirect contribution ratio at 21 per cent.

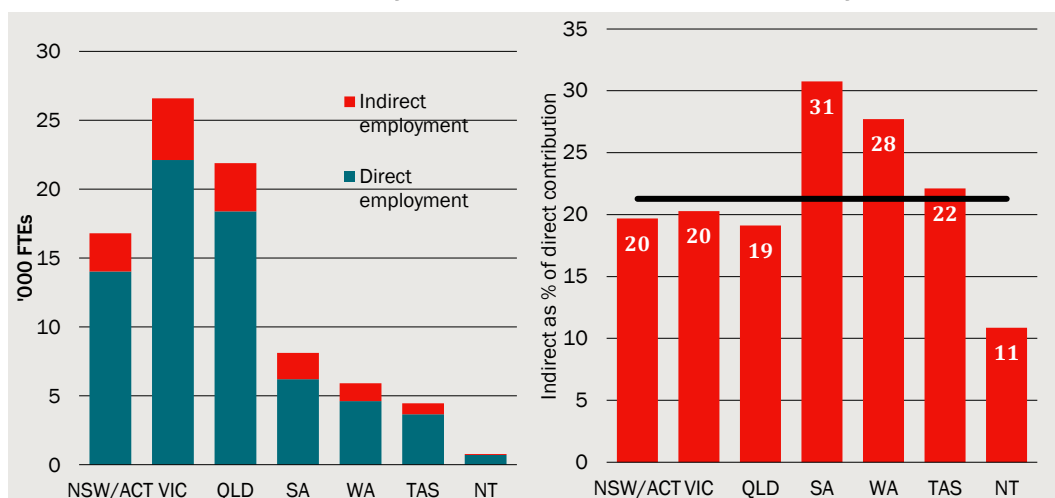
3.7 Direct and indirect contribution of horticultural industry to GSP in 2020-21



Data source: CIE modelling

Chart 3.8 reports the direct and indirect employment contribution of the horticulture industry by state. In general, the indirect employment contribution share is 21 per cent (the black line in the right panel), slightly lower than the indirect GDP/GSP contribution share of 28 per cent. This is because the horticulture industry is more labour intensive than other industries. The boost in other industries has relatively smaller employment impact as opposed to the growth in horticulture industry.

3.8 Direct and indirect employment impact of horticultural industry in 2020-21



Data source: CIE modelling

Contribution to the regional economy

Tables 3.9 and 3.10 report the contribution of horticultural industry to GRP and regional employment, respectively.

3.9 Horticultural industry contribution to GRP in 2020-21

	Direct	Indirect	Total
	\$m	\$m	\$m
NSW/ACT			
Coffs Harbour - Grafton	348.8	85.8	434.6
Richmond - Tweed	238.6	74.1	312.7
Riverina	420.9	114.4	535.3
Murray	240.3	68.7	309.0
Sydney	465.0	239.6	704.6
Rest of NSW/ACT	424.3	140.6	564.9
NSW total	2,137.8	723.2	2,861.0
Victoria			
North West	1,074.5	201.3	1,275.8
Shepparton	644.1	181.1	825.2
Melbourne	840.7	303.6	1,144.3
Rest of Victoria	647.5	187.3	834.8
Victoria total	3,206.8	873.3	4,080.1
Queensland			
Cairns	515.0	82.2	597.2
Wide Bay	601.1	104.3	705.4
Moreton Bay	185.8	43.8	229.6

	Direct	Indirect	Total
	\$m	\$m	\$m
Brisbane	137.1	55.8	192.9
TIDD-M	453.4	112.7	566.2
Rest of Queensland	734.1	176.7	910.8
Queensland total	2,626.5	575.5	3,202.0
South Australia			
South Australia - South East	587.9	170.3	758.2
Adelaide	277.0	129.2	406.3
Rest of SA	39.2	15.0	54.2
SA total	904.2	314.5	1,218.7
Western Australia			
Perth	220.5	64.4	285.0
Bunbury	229.4	62.3	291.7
Rest of WA	187.3	48.5	235.8
WA total	637.3	175.2	812.5
Tasmania			
West and North West	203.6	42.2	245.9
Rest of Tasmania	341.0	72.1	413.1
Tasmania total	544.7	114.3	659.0
Northern Territory			
NT	101.2	28.3	129.5
National	10,158.3	2,804.4	12,962.8

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE modelling

3.10 Horticultural industry contribution to regional employment in 2020-21

	Direct	Indirect	Total
	FTE	FTE	FTE
NSW/ACT			
Coffs Harbour - Grafton	2,262	261	2,523
Richmond - Tweed	1,439	295	1,734
Riverina	2,259	390	2,649
Murray	1,546	244	1,789
Sydney	3,841	1,017	4,859
Rest of NSW/ACT	2,678	554	3,232
NSW total	14,026	2,761	16,786
Victoria			
North West	6,932	907	7,839
Shepparton	3,769	863	4,632

	Direct	Indirect	Total
	FTE	FTE	FTE
Melbourne	6,531	1,708	8,239
Rest of Victoria	4,873	1,008	5,881
Victoria total	22,105	4,486	26,591
Queensland			
Cairns	3,253	461	3,714
Wide Bay	3,887	588	4,475
Moreton Bay	1,307	283	1,590
Brisbane	995	394	1,389
TIDD-M	3,655	681	4,336
Rest of Queensland	5,282	1,108	6,390
Queensland total	18,378	3,515	21,893
South Australia			
South Australia - South East	3,649	1,002	4,651
Adelaide	2,170	813	2,982
Rest of SA	390	95	485
SA total	6,209	1,909	8,119
Western Australia			
Perth	1,662	515	2,177
Bunbury	1,520	422	1,942
Rest of WA	1,441	344	1,785
WA total	4,623	1,281	5,904
Tasmania			
West and North West	1,500	303	1,803
Rest of Tasmania	2,154	505	2,659
Tasmania total	3,654	808	4,462
Northern Territory			
NT	702	76	778
National	69,697	14,835	84,532

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE modelling

4 *Horticulture industry outlook*

Economic and industrial growth is affected by many factors which could be categorised into supply side and demand side variables.

Supply side factors include factors that affects the production of the horticulture commodities.

Productivity improvement is the most important supply side factor, which determines the volume of goods and services that can be produced with a given amount of resources. Productivity is often presented by labour productivity, output per unit of labour input, or total factor productivity (TFP), output per unit of a combined set of inputs such as labour, capital, land and materials. TFP, which is also called multi-factor productivity (MFP), is a measure of an economy's long-term technological change. This analysis uses TFP estimates as inputs into the projection modelling.

Inputs into the production process, such as labour, land, water and other resources and materials, are important supply side factors. Price changes of these inputs are often used for modelling to indicate the scarcity of these resources.

Demand side factors include factors affecting export and domestic demand.

Population growth is an important demand side factor of regional economic growth. It is mostly obvious because increases to the population base will stimulate demand for more horticulture commodities. Population growth could present supply side impact as well through growth in labour supply.

Another demand side factor is the external demand for goods and services (from outside Australia), which is driven by global economic and population growth.

The categorisation of supply and demand side factors is not clear cut. For example, as mentioned above, population growth could have supply side impact because of labour supply increase along with population growth.

These factors are exogenous shocks to the economic models to produce the horticulture industry outlook.

It should be noted that the projection is carried out from a base year of 2020-21 and thus the assumptions about outlook factors should be considered as a change from the conditions in the base year. For example, the labour market, especially the seasonal worker shortage for horticulture, will be easing with the removal of restrictions related to the COVID-19 pandemic.

Outlook assumptions

There are significant uncertainties associated with the assumed factors and thus the projection results. Three scenarios are developed to reflect the uncertainties around the assumed factors:

- Central scenario – reflecting the most common and long term average conditions going forward;
- High scenario – reflecting more favourable conditions, for example more rapid recovery in the global economy, higher domestic productivity improvement and more favourable weather conditions; and
- Low scenario – reflecting more pessimistic assumptions about future developments

The assumptions for the outlook are summarised in table 4.1.

4.1 Summary of outlook assumptions

	Central	High	Low
Export demand factors			
Global economic growth	3.26%pa by 2027, then to 3.3%pa by 2030	0.8 percentage point higher than Central assumption	0.59 percentage point lower than Central assumption
Exchange rate	US\$0.7283/A\$ in 2021-22, US\$0.765 in 2023-24, and US\$0.75 in 2026-27, then to US\$0.761 by 2029-30	same as Central	same as Central
Export price	Export price change to ensure aggregated export value change follow the ABARES projections to 2027; and then grow by the historical average rate (~4.1%pa)	A quarter of the standard deviation of export price change added to the Central assumption	A quarter of the standard deviation of export price change subtracted from the Central assumption
Australian macro factors			
Australian income (per capita GDP) growth	IMF projection up to 2027, and then gradual rise to the long-term growth rate of 1.44%pa by 2029-30	0.5 percentage point above the Central assumption	0.25 percentage point below the Central assumption
Australian population growth	ABS medium series projection (1.48% in 2024-25, 1.31% in 2029-30)	ABS high series projection (1.73% in 2024-25, 1.62% in 2029-30)	ABS low series projection (1.24% in 2024-25, 1.01% in 2029-30)
Productivity in horticulture farming	1.2% pa	1.6% pa	0.8% pa
Productivity in horticulture processing	0.5% pa	0.75% pa	0.25% pa

	Central	High	Low
Labour market condition	labour cost increases by 2.4% pa up to 2022-23 and then gradually to 0.5% pa by 2029-30	labour cost increases by 2% pa up to 2022-23 and then gradually to 0.4% pa by 2029-30	labour cost increases by 3% pa up to 2022-23 and then gradually to 0.6% pa by 2029-30
Weather condition			
Water price	wet condition to continue - water price fall to \$57/ML by 2022-23 and then gradually rise to \$130/ML by 2029-30	water price fall to \$57/ML by 2022-23 and then stay at that level for the rest of period	water price fall to \$77/ML bin 2021-22, and then gradually rise to \$151.5/ML by 2029-30
Other input costs			
Fuels	price index peak at 223 in June 2022, then fall to 117 in June 2026, before gradual rising to 133 by June 2030	10% lower than the Central assumptions	9.3% higher than the Central assumptions
Chemicals	price index peak at 197 in December 2022, then fall to 113 in March 2027, before gradual rising to 120 by June 2030	17% lower than the Central assumptions	17% higher than the Central assumptions

Source: CIE assumptions

It should be noted that the High and Low scenarios are about the horticulture industry outlooks rather than about the input costs (prices). Because input costs affect the production adversely, the High and Low scenarios assume low and high input prices respectively.

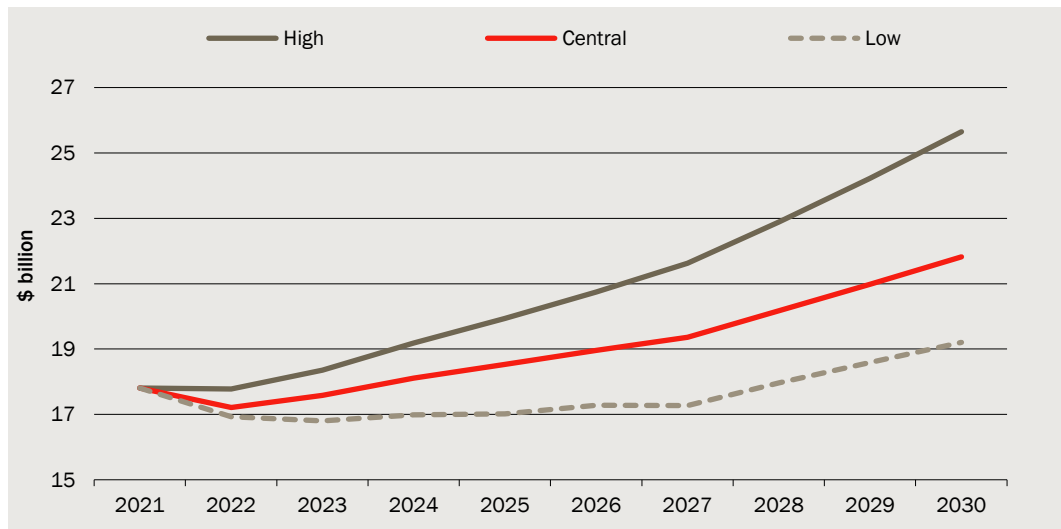
The derivation of the assumptions for these scenarios are presented in appendix B. The discussion is focused on the Central scenario, with the High and Low scenarios being deviation from the Central one. In most cases the deviation of High and Low scenarios from the Central scenario are determined according to the standard deviation of the historical data.

National outlook

Projection comparison under different scenarios

With the above assumptions, it is projected that the gross value of product (GVP) of the horticulture industry will reach \$21.8 billion under the Central scenario, \$25.6 billion under the High scenario or \$19.2 billion under the Low scenario by 2030 (chart 4.3). The High and Low scenarios present a deviation of 18 per cent above and a 12 per cent below, respectively, the projected GVP in 2029-30 under the Central case.

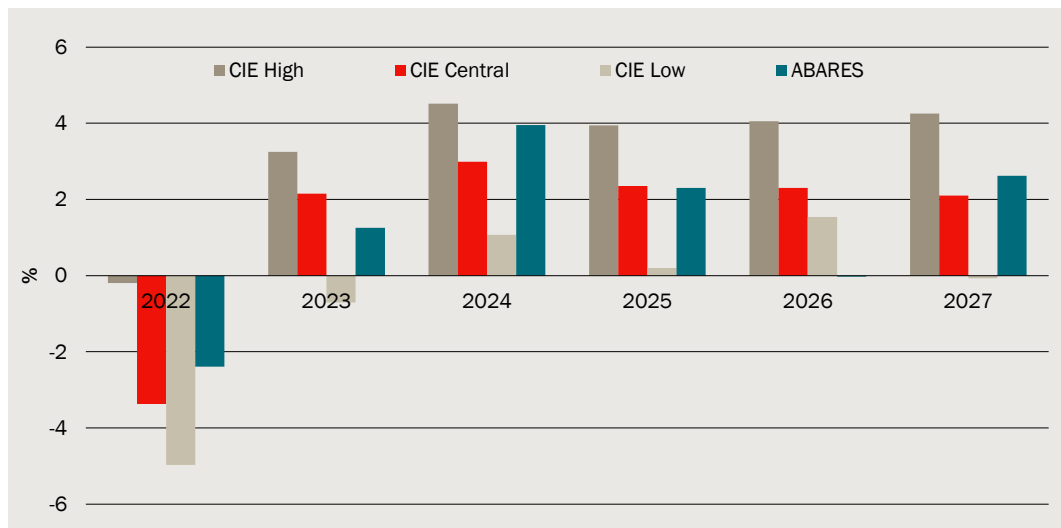
4.2 Projected horticulture GVP by scenario



Data source: CIE modelling

Chart 4.3 compares our projected horticulture GVP growth with those by ABARES²⁰. Our Central scenario presents a bigger fall in 2021-22 than ABARES. This is likely due to our assumed input cost hikes are bigger than those by the ABARES March outlook that may not factor in the Russia-Ukraine war and its consequences. Our higher growth projection in 2022-23 under the Central scenario is mainly due to a catch up from the low in the previous year.

4.3 Comparison of projected horticulture GVP growth



Data source: ABARES and CIE

²⁰ ABARES 2022, *Australian Commodities: June quarter 2022*, <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook/data#agricultural-commodities>. The latest September quarter 2022 outlook did not provide details for horticulture industry.

It can be seen also from the chart that our projections in other years under the Central scenario are smoother than those by ABARES, most notably in 2025-2026 when a tiny fall is projected by ABARES, due to the more average assumptions that we use as discussed above.

Overall, our Central scenario represents an 8.7 per cent increase in real horticulture GVP over the period between 2020-21 and 2026-27, slightly higher than the 7.8 per cent increase projected by ABARES over the same period.

ACIL Allen projected the value of horticulture (farming) industry will reach \$14.6 billion by 2030, representing an increase of \$4.83 billion, or 33.1 per cent, from \$9.76 billion in 2016-17.²¹

Our projection of horticulture farming sector GVP in 2029-30 is significantly higher, being \$18.5 billion. This is mainly due to higher base value than the ACIL Allen projection – the horticulture GVP was \$12.92 billion in 2016-17 according to *Australian Horticulture Statistics Handbook*, which is 32.3 per cent higher than the ACIL Allen's base value. In fact, our projected overall growth of horticulture farming over the period from 2016-17 to 2029-30 is 43.3 per cent, lower than the growth of 49.5 per cent over the same period by ACIL Allen, due to the impacts of COVID-19 pandemic and the Russia-Ukraine war that were not foreseen in the ACIL Allen forecast.

Table 4.4 compares the projected sectoral GVP in 2030 under different scenarios.

Tree nuts appear the most significant horticulture commodities that have the highest difference across scenarios with different projection assumptions. Under the High scenario, the GVP of almonds and other nuts in 2030 would be more than doubled compared to the Central case, while the projected value under the Low scenario would be less than half of the Central projection. This is because tree nuts have a high export share and as a result their production is more responsive to market conditions and highly sensitive to input costs, especially the water prices.

Other temperate fruit production is also sensitive to input costs, with the deviation from the Central case projection in 2030 being more than 30 per cent.

Some vegetables, such as tomatoes for fresh consumption, lettuce, are concentrated in the domestic market and their demand is determined by the population change which has relatively small variance across scenario. As a result, their productions will not change too much across scenarios.

Nursery and bananas also present small variance across scenarios due to similar reason that there is no or very small proportion of the products being exported.

²¹ ACIL Allen Consulting 2019, *Agriculture – A \$100b sector by 2030?*, AgriFutures National Rural Issues, August 2019, Table 1.1, p.14.

4.4 Comparison of sectoral GVP in 2030 under different scenarios

	High	Central	Low
	\$m	\$m	\$m
Fruit			
Apples	753.6	707.4	662.1
Pears and nashis	186.5	172.0	155.8
Summer fruit	467.0	426.2	384.1
Cherries	326.7	297.4	265.3
Strawberries	524.8	482.2	441.4
Rubus	789.2	739.5	691.6
Kiwi fruit	41.1	36.9	31.8
Oranges	709.1	628.4	539.0
Mandarins	526.4	466.7	397.8
Other citrus	187.8	169.7	151.5
Grapes - Table and Other	885.0	819.2	740.0
Grapes - Total Dried	36.1	33.4	30.2
Other temperate fruit	47.9	36.6	24.1
Bananas	723.4	680.6	637.5
Pineapples	58.5	54.8	51.0
Avocados	717.7	649.4	581.7
Mangoes	237.8	211.7	189.2
Melons	198.2	180.6	163.8
Other tropical fruit	142.5	127.7	117.1
Olives	233.2	208.4	183.2
Fruit sub-total	7,792.5	7,128.9	6,438.4
Nuts			
Macadamia	942.8	589.3	315.7
Almonds	2,469.9	1,027.8	513.3
Other nuts	525.8	209.3	99.7
Nuts sub-total	3,938.6	1,826.4	928.7
Vegetables			
Potatoes	1,059.6	957.7	861.3
Carrots	350.1	318.4	280.1
Onions	271.2	252.4	229.4
Pumpkins	114.4	104.4	96.1
Sweet corn	143.3	133.2	123.8
Peas and beans	181.7	164.7	149.3
Lettuce	194.3	186.9	180.1
Broccoli	344.8	312.0	282.7
Cauliflower	76.3	71.4	66.8
Capsicums; Chillies & Peppers	249.4	233.9	218.2

	High	Central	Low
	\$m	\$m	\$m
Tomatoes - processing	52.2	47.1	42.6
Tomatoes - fresh	590.9	568.8	545.9
Asparagus	108.9	101.7	93.0
Mushrooms	487.8	453.8	418.6
Garlic and herbs	323.4	301.5	277.5
Other vegetables	1,643.4	1,514.7	1,398.1
Vegetables sub-total	6,191.4	5,722.6	5,263.2
Nursery			
Nursery	3,319.4	3,165.5	3,040.4
Cultivated turf	372.2	352.7	336.6
Cut flowers	360.2	335.7	312.4
Nursery subtotal	4,051.7	3,853.9	3,689.4
Total farming	21,974.2	18,531.8	16,319.8
Processing			
Frozen potatoes	853.8	778.4	704.4
Canned tomatoes	351.0	317.4	286.9
Other processed vegetables	478.0	429.7	382.0
Processed fruits and jams	921.3	770.8	594.9
Orange and other juice	773.5	724.4	677.0
Olive oil	296.5	265.6	234.0
Processing subtotal	3,674.1	3,286.4	2,879.1
Total horticulture	25,648.3	21,818.2	19,198.9

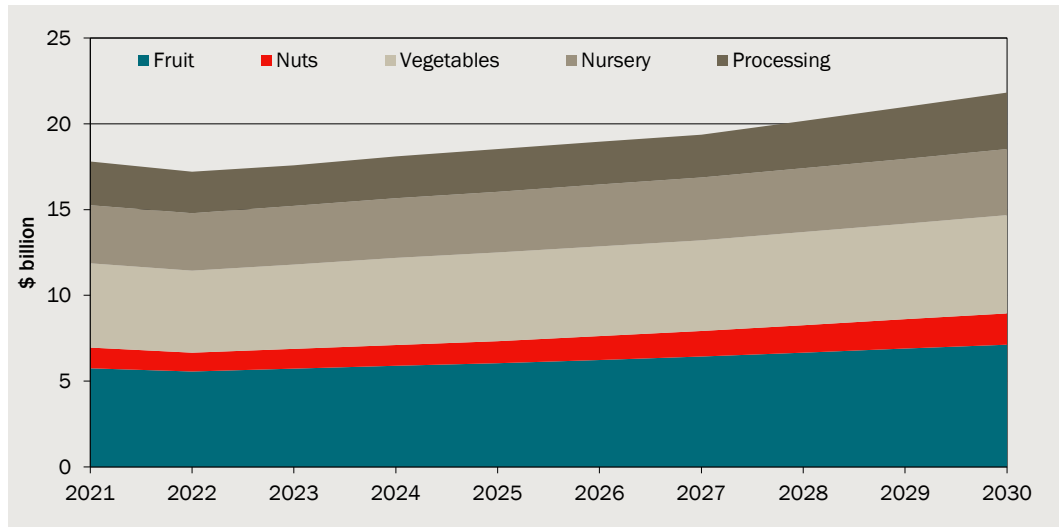
Source: CIE modelling

Projection results under the Central scenario

Chart 4.5 reports the projected horticulture industry GVP by broad category up to 2030 from the modelling under the Central scenario.

It is projected that horticulture GVP will fall by 3.4 per cent in 2021-22, before continuous growth up to 2030 with a total GVP of \$21.8 billion in real terms. As discussed above, the fall in 2021-22 is mainly due to the rise in input costs.

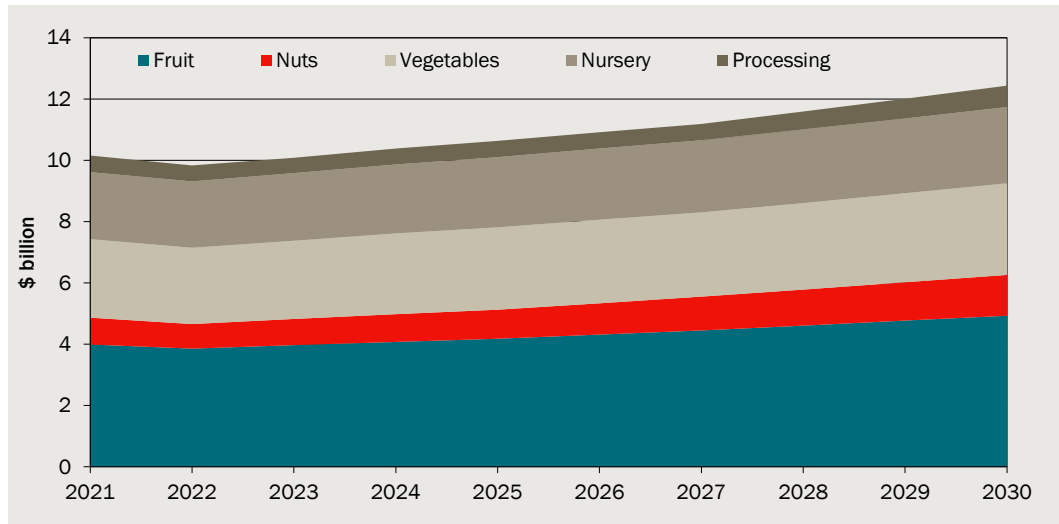
4.5 Projected Australian horticulture GVP by broad category, Central scenario



Data source: CIE modelling

Chart 4.6 shows the projected value added of horticulture up to 2030 under the Central scenario. The value added series follows a similar pattern to the GVP series. It is projected to a fall of 3.2 per cent to \$9.83 billion in 2021-22, followed by continuous growth to \$12.44 billion in 2029-30.

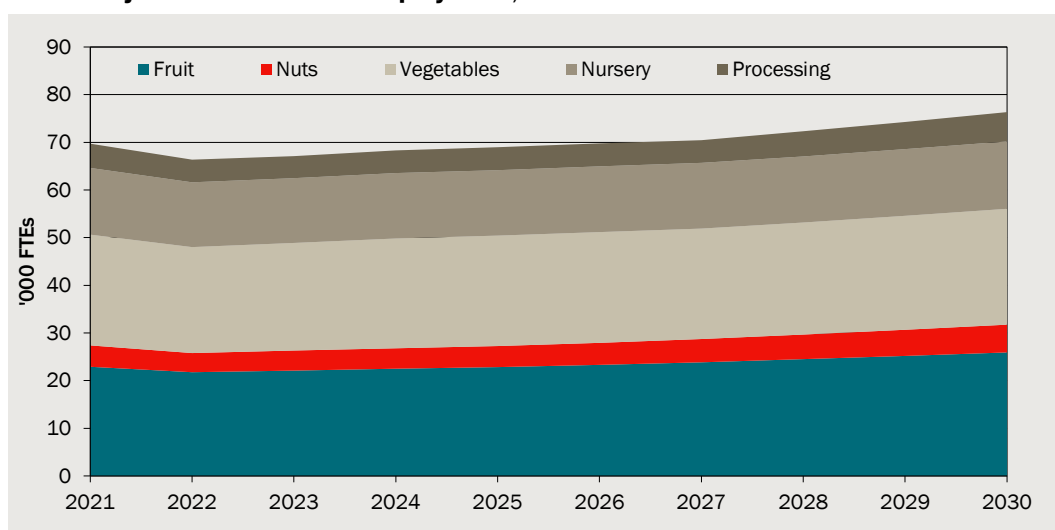
4.6 Projected horticulture value added by broad category, Central scenario



Data source: CIE modelling

Similarly, it is projected that total horticulture employment will fall to 66 360 FTEs in 2021-22 and then increase to 76 370 FTEs in 2029-30 under the Central scenario (chart 4.7). The lower growth in horticulture employment is mainly due to the assumed productivity improvement – less labour required to produce the same amount of commodities.

4.7 Projected horticulture employment, Central scenario



Data source: CIE modelling

Table 4.8 reports the Central case projection of Australian horticulture production value, value added and employment in 2029-30 along with the base year levels in 2020-21.

4.8 Projected national horticulture production, value added and employment in 2029-30, Central scenario

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	FTE	FTE	%
Fruit									
Apples	619.9	707.4	14.1	484.1	552.4	14.1	1,818	1,863	2.5
Pears and nashis	144.9	172.0	18.7	113.1	134.3	18.7	425	457	7.4
Summer fruit	338.9	426.2	25.7	231.0	290.4	25.7	701	807	15.2
Cherries	231.3	297.4	28.6	203.7	261.8	28.6	478	566	18.4
Strawberries	417.2	482.2	15.6	247.3	285.8	15.6	2,324	2,415	3.9
Rubus	644.1	739.5	14.8	563.3	646.8	14.8	3,587	3,681	2.6
Kiwi fruit	24.4	36.9	51.2	16.8	25.4	51.2	157	223	42.0
Oranges	437.6	628.4	43.6	308.8	443.4	43.6	1,604	2,159	34.6
Mandarins	341.9	466.7	36.5	259.8	354.6	36.5	1,253	1,567	25.1
Other citrus	156.8	169.7	8.2	125.8	136.1	8.2	575	554	-3.6
Grapes - Table and Other	631.8	819.2	29.7	392.6	509.0	29.7	3,226	3,913	21.3
Grapes - Total Dried	25.3	33.4	32.1	15.7	20.8	32.1	129	162	25.1
Other temperate fruit	23.6	36.6	55.1	16.8	26.1	55.1	88	122	38.3
Bananas	596.8	680.6	14.0	360.8	411.5	14.0	2,225	2,274	2.2
Pineapples	46.8	54.8	17.0	25.7	30.1	17.0	174	180	2.9

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	FTE	FTE	%
Avocados	488.7	649.4	32.9	268.4	356.7	32.9	1,822	2,315	27.0
Mangoes	167.4	211.7	26.5	92.0	116.3	26.5	624	732	17.2
Melons	149.0	180.6	21.2	71.7	86.9	21.2	674	739	9.7
Other tropical fruit	104.7	127.7	22.0	57.5	70.2	22.0	390	423	8.2
Olives	161.2	208.4	29.3	131.1	169.5	29.3	642	743	15.8
Fruit sub-total	5,752.3	7,128.9	23.9	3,985.9	4,928.2	23.6	22,916	25,893	13.0
Nuts									
Macadamia	339.1	589.3	73.8	223.9	389.2	73.8	1,264	2,079	64.4
Almonds	721.6	1,027.8	42.4	549.6	782.8	42.4	2,690	3,153	17.2
Other nuts	135.5	209.3	54.4	104.6	161.6	54.4	505	647	28.1
Nuts sub-total	1,196.2	1,826.4	52.7	878.1	1,333.6	51.9	4,460	5,878	31.8
Vegetables									
Potatoes	807.3	957.7	18.6	480.2	569.6	18.6	3,651	3,897	6.7
Carrots	256.0	318.4	24.4	125.5	156.1	24.4	1,158	1,313	13.4
Onions	203.2	252.4	24.2	105.7	131.3	24.2	919	1,044	13.6
Pumpkins	89.4	104.4	16.7	40.2	46.9	16.7	404	418	3.5
Sweet corn	117.1	133.2	13.7	54.5	61.9	13.7	530	536	1.3
Peas and beans	143.5	164.7	14.8	103.4	118.7	14.8	649	659	1.5
Lettuce	171.9	186.9	8.7	67.5	73.4	8.7	777	751	-3.4
Broccoli	258.9	312.0	20.5	126.0	151.9	20.5	1,171	1,269	8.3
Cauliflower	63.1	71.4	13.2	32.9	37.2	13.2	285	289	1.4
Capsicums; Chillies & Peppers	206.4	233.9	13.3	105.9	120.0	13.3	933	947	1.5
Tomatoes - processing	36.1	47.1	30.5	24.7	32.2	30.5	163	185	13.0
Tomatoes - fresh	526.1	568.8	8.1	244.8	264.7	8.1	2,379	2,298	-3.4
Asparagus	81.1	101.7	25.4	71.3	89.5	25.4	367	419	14.3
Mushrooms	393.1	453.8	15.4	211.6	244.3	15.4	2,832	2,910	2.8
Garlic and herbs	259.2	301.5	16.3	155.5	180.9	16.3	1,172	1,222	4.3
Other vegetables	1,301.4	1,514.7	16.4	611.3	711.5	16.4	5,886	6,149	4.5
Vegetables sub-total	4,913.8	5,722.6	16.5	2,561.0	2,990.1	16.8	23,277	24,306	4.4
Nursery									
Nursery	2,789.5	3,165.5	13.5	1,805.0	2,048.2	13.5	9,983	9,981	0.0
Cultivated turf	308.0	352.7	14.5	216.5	247.9	14.5	1,333	1,354	1.6
Cut flowers	290.2	335.7	15.7	164.8	190.6	15.7	2,677	2,760	3.1

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	FTE	FTE	%
Nursery subtotal	3,387.7	3,853.9	13.8	2,186.2	2,486.8	13.7	13,993	14,096	0.7
Total farming	15,250.0	18,531.8	21.5	9,611.3	11,738.6	22.1	64,646	70,173	8.6
Processing									
Frozen potatoes	652.4	778.4	19.3	148.5	177.2	19.3	1,371	1,563	14.0
Canned tomatoes	243.3	317.4	30.5	55.4	72.2	30.5	511	637	24.7
Other processed vegetables	350.0	429.7	22.8	79.7	97.8	22.8	736	863	17.3
Processed fruits and jams	529.9	770.8	45.5	120.6	175.5	45.5	1,114	1,548	39.0
Orange and other juice	576.2	724.4	25.7	131.2	164.9	25.7	1,211	1,455	20.1
Olive oil	206.3	265.6	28.8	11.7	15.1	28.8	108	134	23.5
Processing subtotal	2,558.1	3,286.4	28.5	547.1	702.7	28.4	5,051	6,199	22.7
Total horticulture	17,808.1	21,818.2	22.5	10,158.3	12,441.3	22.5	69,697	76,372	9.6

^a total growth from 2020-21 to 2029-30

Source: CIE modelling

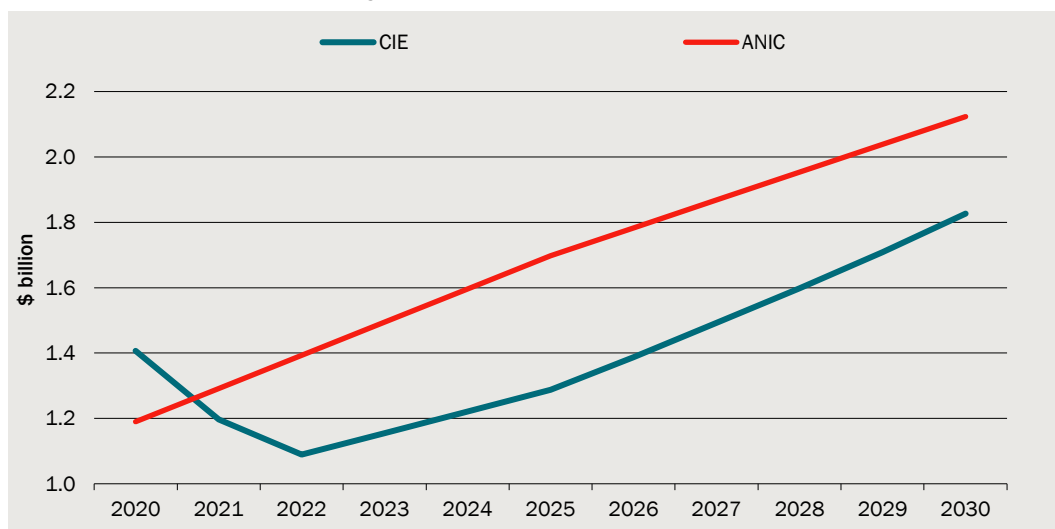
Compared to the base year level, nuts and some fruit commodities have the highest growth rates, mainly due to the assumed greater export opportunities.

That said, the projected GVP of nuts in 2030 is still lower than the industry projection of \$2.1 billion.²² This is mainly due to the new information emerging from the pandemic and the war and the resultant lower bases as well as lower growth prospects in the next few years.

Chart 4.9 illustrates the differences between the projections. Production value of nuts fell from \$1.4 billion in 2019-20 to \$1.2 billion in 2020-21 according to the AHSH, and the fall is projected to continue in 2021-22 with a GVP of \$1.1 billion as a result of the assumed adverse economic and market conditions, before continuous growing for the rest of the projection period. By contrast, the Australian Nut Industry Council (ANIC) outlook presents a continuous growth over the whole period.

²² ANIC 2020, *Strategic Blueprint 2030*, Australian Nut Industry Council, October 2020, available at <https://nutindustry.org.au/wp-content/uploads/2021/02/ANIC-Strategic-Blueprint-Oct-2020.pdf>

4.9 Comparison of nuts projections



Data source: ANIC, HIA and CIE

Citrus Australia projected that citrus production would increase by 1.1 per cent in volume from 2020 to 2025.²³ Our projection suggested a higher growth in GVP at about 5 per cent from 2020-21 to 2024-25 under the Central scenario, reflecting the recent trend of price increase.

Avocado Strategic Investment Plan 2022-26 projected a jump of more than 50 per cent in production from 78 085 tonnes in 2020-21 to 120 298 tonnes in 2021-22, and then a further 12.7 per cent to 87.8 per cent growth in production from 2021-22 to 2025-26 depending on the yield assumption scenarios.²⁴ However, given the recent fall in price, for example the average farm gate price in 2020-21 was 7.4 per cent lower than that in 2017-18, and the retail prices for 2022 remain 47 per cent below the five-year average,²⁵ the GVP is projected to increase at a much lower pace – 12.4 per cent increase from 2020-21 to 2025-26.

The fall in price is due to the ‘oversupply’ in the domestic market – currently only 4 per cent of avocados are exported. This suggests the importance of export market for future growth.

Commodities focusing on domestic market will generally have a low growth. Another example is bananas which is projected to have limited growth – 14 per cent growth from 2020-21 to 2029-30. This is due to the fact that no bananas are exported, and that domestic market experiences saturation. Stakeholders have pointed out that there are plenty of bananas in the market and growers are not making money.

²³ Harty, A. and N. Hancock 2015, *Citrus Production Outlook 2016-2025*, December 2015, Citrus Australia

²⁴ Hort Innovation 2021, *Avocado Strategy Investment Plan 2022-2026*, Figure 8, p.27

²⁵ Adams, R. 2022, ‘Avolanche: Cheap avocados here to stay, report finds’, *Stockhead*, 26 July 2022, <https://stockhead.com.au/food-agriculture/avolanche-cheap-avocados-here-to-stay-report-finds/>

Regional outlook

Variance across scenarios

Table 4.10 compares the projected regional horticulture GVP across scenarios.

North West (Mildura) region in Victoria, Riverina, Richmond – Tweed and Murray regions in NSW and South East region (Adelaide Plains) in SA presents the highest variance across scenarios. This is because these regions have higher proportion of export-oriented horticultural commodities as discussed above. For example, Riverina has high proportion of citrus, almonds and other nuts, accounting for half of total horticulture production in the region. In North West (Mildura) region of Victoria, table grapes and almonds account for 56 per cent of total horticulture production in the region.

4.10 Regional horticulture GVP comparison under different scenarios (2029-30)

	High	Central	Low
	\$m	\$m	\$m
New South Wales and ACT			
Coffs Harbour - Grafton	568.7	521.8	475.8
Richmond - Tweed	653.4	502.8	385.2
Riverina	1,236.3	843.6	661.4
Murray	617.5	493.8	422.6
Sydney	1,337.4	1,244.9	1,156.8
Rest of NSW/ACT	941.9	830.6	747.6
NSW/ACT total	5,355.2	4,437.4	3,849.4
Victoria			
North West	3,295.6	2,228.7	1,737.1
Shepparton	1,651.9	1,502.8	1,347.2
Melbourne	1,948.6	1,814.1	1,686.6
Rest of Victoria	1,585.9	1,436.2	1,310.7
Victoria total	8,482.1	6,981.9	6,081.6
Queensland			
Cairns	1,088.2	1,013.0	940.7
Wide Bay	1,555.8	1,294.8	1,070.0
Moreton Bay	393.0	361.1	331.4
Brisbane	459.2	425.5	393.7
TIDD-M	1,158.8	1,071.7	988.6
Rest of Queensland	1,732.3	1,568.6	1,421.2
Queensland total	6,387.2	5,734.7	5,145.6
South Australia			
South Australia - South East	1,618.4	1,213.5	993.8
Adelaide	732.3	668.1	608.5

	High	Central	Low
	\$m	\$m	\$m
Rest of SA	101.5	94.4	87.7
SA total	2,452.2	1,976.1	1,690.0
Western Australia			
Perth	517.0	483.4	451.4
Bunbury	562.8	503.5	449.2
Rest of WA	452.6	415.0	376.7
WA total	1,532.5	1,401.9	1,277.3
Tasmania			
West and North West	454.2	414.2	373.9
Rest of Tasmania	743.4	652.1	580.5
Tasmania total	1,197.5	1,066.3	954.4
Northern Territory			
NT	241.6	219.8	200.7
Australia	25,648.3	21,818.2	19,198.9

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

Source: CIE modelling

Central case outlook

Table 4.11 reports the projected regional horticulture GVP, value added and employment in 2029-30 under the Central scenario.

North West (Mildura) and Melbourne in Victoria and Rest of Queensland remain the top three producing regions in 2029-30, while Richmond – Tweed and Riverina in NSW, North West (Mildura) in Victoria, and Wide Bay in Queensland will have the fastest growth, with more than 30 per cent increase in real GVP from 2020-21 to 2029-30.

4.11 Projected regional horticulture production, value added and employment under Central scenario

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	\$m	\$m	%
New South Wales and ACT									
Coffs Harbour - Grafton	441.4	521.8	18.2	348.8	405.7	16.3	2,262	2,367	4.6
Richmond - Tweed	371.5	502.8	35.3	238.6	323.8	35.7	1,439	1,767	22.7
Riverina	636.7	843.6	32.5	420.9	560.5	33.2	2,259	2,660	17.8
Murray	391.1	493.8	26.3	240.3	304.8	26.9	1,546	1,755	13.6

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	\$m	\$m	%
Sydney	1,057.1	1,244.9	17.8	465.0	540.6	16.3	3,841	4,059	5.7
Rest of NSW/ACT	687.0	830.6	20.9	424.3	512.1	20.7	2,678	2,880	7.6
NSW/ACT total	3,584.8	4,437.4	23.8	2,137.8	2,647.5	23.8	14,026	15,489	10.4
Victoria									
North West (Mildura)	1,689.5	2,228.7	31.9	1,074.5	1,426.2	32.7	6,932	8,128	17.2
Shepparton	1,221.9	1,502.8	23.0	644.1	774.9	20.3	3,769	4,142	9.9
Melbourne	1,546.7	1,814.1	17.3	840.7	976.6	16.2	6,531	6,822	4.5
Rest of Victoria	1,208.2	1,436.2	18.9	647.5	767.0	18.5	4,873	5,144	5.6
Victoria total	5,666.3	6,981.9	23.2	3,206.8	3,944.6	23.0	22,105	24,236	9.6
Queensland									
Cairns	862.7	1,013.0	17.4	515.0	602.7	17.0	3,253	3,450	6.1
Wide Bay	985.7	1,294.8	31.4	601.1	794.1	32.1	3,887	4,645	19.5
Moreton Bay	307.4	361.1	17.5	185.8	216.2	16.4	1,307	1,364	4.4
Brisbane	362.1	425.5	17.5	137.1	159.1	16.0	995	1,066	7.2
TIDD-M	911.1	1,071.7	17.6	453.4	529.7	16.8	3,655	3,849	5.3
Rest of Queensland	1,313.0	1,568.6	19.5	734.1	874.6	19.1	5,282	5,659	7.1
Queensland total	4,741.8	5,734.7	20.9	2,626.5	3,176.4	20.9	18,378	20,034	9.0
South Australia									
South Australia - South East	941.5	1,213.5	28.9	587.9	762.7	29.7	3,649	4,198	15.1
Adelaide	562.5	668.1	18.8	277.0	327.5	18.2	2,170	2,305	6.2
Rest of SA	82.2	94.4	14.8	39.2	45.0	14.7	390	401	2.7
SA total	1,586.2	1,976.1	24.6	904.2	1,135.1	25.5	6,209	6,904	11.2
Western Australia									
Perth	412.7	483.4	17.1	220.5	255.9	16.0	1,662	1,733	4.2
Bunbury	405.6	503.5	24.1	229.4	282.4	23.1	1,520	1,719	13.1
Rest of WA	343.1	415.0	21.0	187.3	225.9	20.6	1,441	1,560	8.2
WA total	1,161.4	1,401.9	20.7	637.3	764.2	19.9	4,623	5,011	8.4
Tasmania									
West and North West	346.9	414.2	19.4	203.6	241.2	18.4	1,500	1,610	7.3
Rest of Tasmania	540.2	652.1	20.7	341.0	409.4	20.1	2,154	2,311	7.3
Tasmania total	887.1	1,066.3	20.2	544.7	650.6	19.5	3,654	3,920	7.3
Northern Territory									

	GVP			Value added			Employment		
	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a	2020-21	2029-30	Growth ^a
	\$m	\$m	%	\$m	\$m	%	\$m	\$m	%
NT	180.5	219.8	21.8	101.2	122.8	21.4	702	778	10.9
Australia	17,808.1	21,818.2	22.5	10,158.3	12,441.3	22.5	69,697	76,372	9.6

^a total growth from 2020-21 to 2029-30

Note: TIDD-M: Toowoomba, Ipswich, Darling Downs – Maranoa

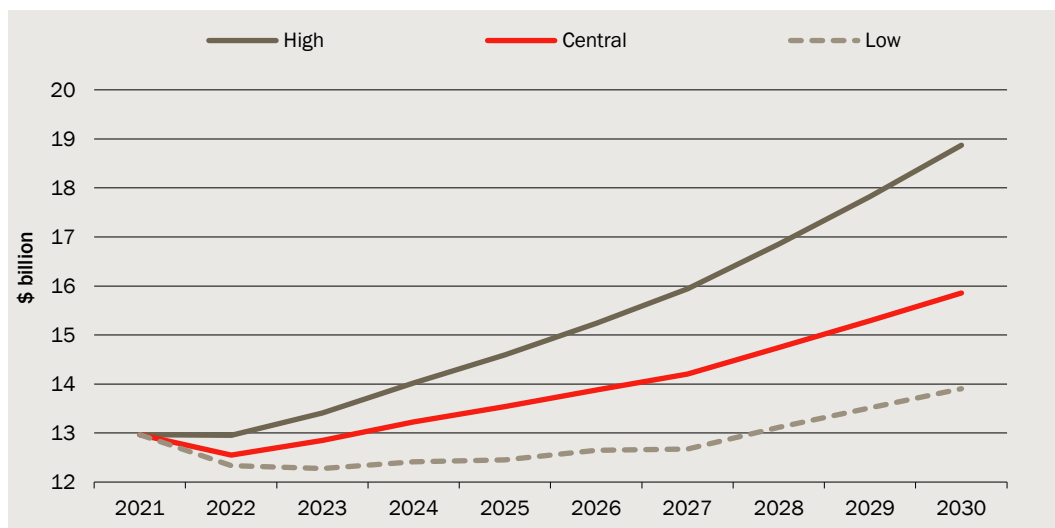
Source: CIE modelling

Projected contribution to the economy

Comparison of contribution across scenarios

It is estimated that the total contribution of the horticulture industry to GDP in 2029-30 will be \$15.85 billion, \$18.87 billion, and \$13.91 billion, respectively, under the Central, High, and Low scenarios (chart 4.12). The deviations of the High and Low scenarios from the Central scenario are similar to those in GVP and value added in percentage terms.

4.12 Comparison of total horticulture contribution to GDP by scenarios

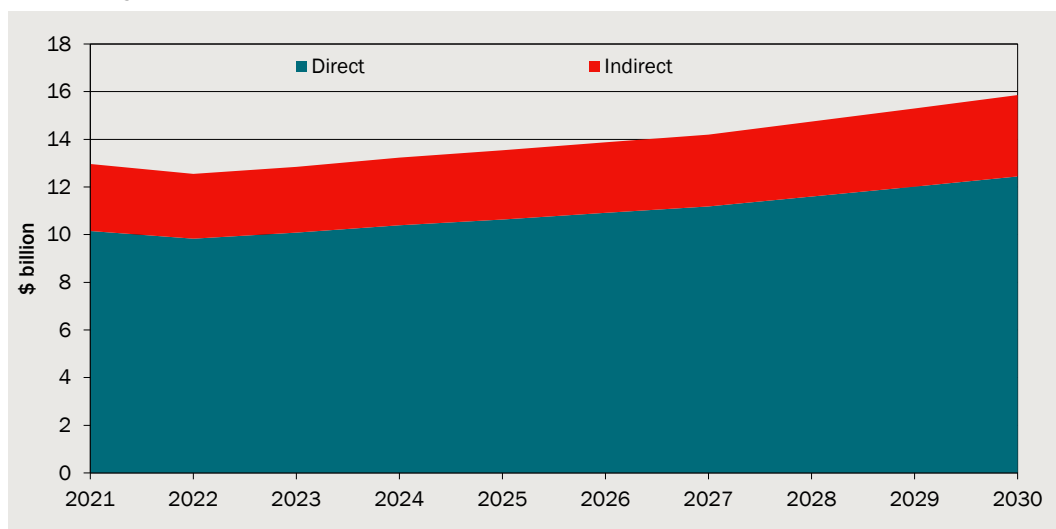


Data source: CIE modelling

Projected contributions under the Central scenario

Chart 4.13 shows projected horticulture contribution to GDP up to 2029-30 under the Central scenario. It is projected that the industry will have additional indirect contribution of \$3.41 billion to GDP, resulting in a total contribution of \$15.85 billion.

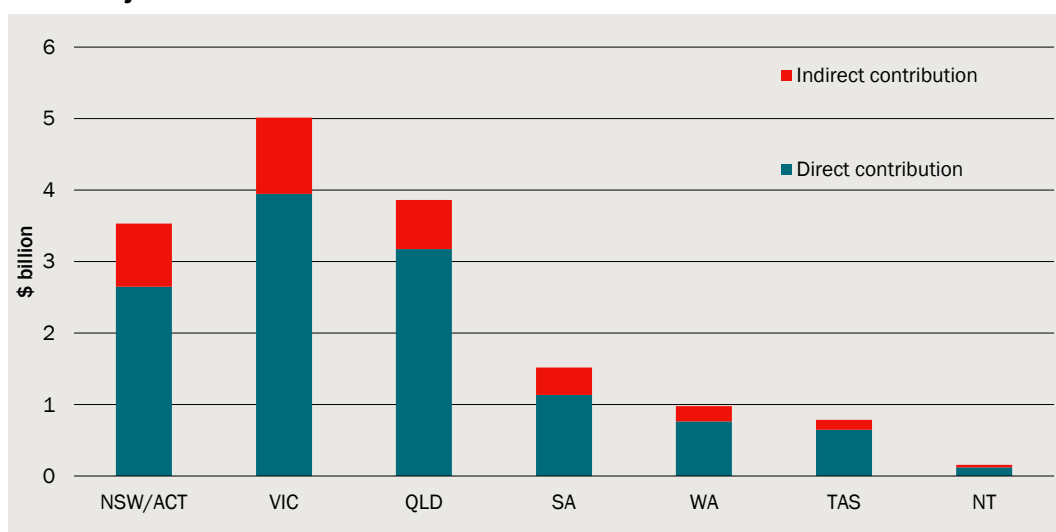
4.13 Projected contribution to GDP under the Central scenario



Data source: CIE modelling

Chart 4.14 and table 4.15 report the industry’s contribution to GSP and GRP, respectively, in 2029-30 under the Central scenario.

4.14 Projected contribution to GSP in 2029-30 under the Central scenario



Data source: CIE modelling

4.15 Contribution to GRP in 2029-30 under the Central scenario

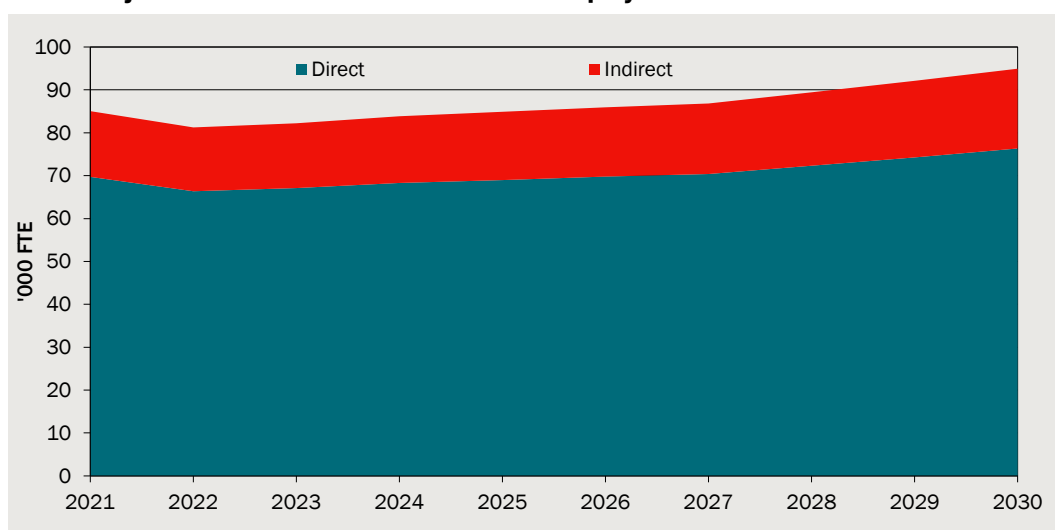
	Direct	Indirect	Total
	\$m	\$m	\$m
New South Wales and ACT			
Coffs Harbour - Grafton	405.7	102.5	508.1
Richmond - Tweed	323.8	95.7	419.5
Riverina	560.5	150.1	710.6
Murray	304.8	85.9	390.8

Sydney	540.6	282.3	823.0
Rest of NSW/ACT	512.1	168.9	680.9
NSW/ACT total	2,647.5	885.3	3,532.9
Victoria			
North West	1,426.2	261.8	1,687.9
Shepparton	774.9	229.9	1,004.8
Melbourne	976.6	354.6	1,331.2
Rest of Victoria	767.0	222.5	989.4
Victoria total	3,944.6	1,068.7	5,013.3
Queensland			
Cairns	602.7	96.0	698.7
Wide Bay	794.1	134.1	928.3
Moreton Bay	216.2	51.2	267.4
Brisbane	159.1	65.2	224.3
TIDD-M	529.7	132.5	662.3
Rest of Queensland	874.6	208.1	1,082.7
Queensland total	3,176.4	687.2	3,863.6
South Australia			
South Australia - South East	762.7	214.4	977.1
Adelaide	327.5	154.2	481.7
Rest of SA	45.0	17.3	62.3
SA total	1,135.1	385.9	1,521.0
Western Australia			
Perth	255.9	77.0	332.9
Bunbury	282.4	77.6	360.0
Rest of WA	225.9	58.6	284.5
WA total	764.2	213.2	977.4
Tasmania			
West and North West	241.2	50.7	291.9
Rest of Tasmania	409.4	87.6	497.0
Tasmania total	650.6	138.3	788.9
Northern Territory			
NT	122.8	34.4	157.2
Australia	12,441.3	3,413.2	15,854.4

Source: CIE modelling

Chart 4.16 reports the projected horticulture contribution to national employment. It is projected that the horticulture industry will induce additional employment by 17 914 FTEs, resulting in a total contribution of 94 286 FTEs in 2029-30.

4.16 Projected horticulture contribution to employment under the Central scenario



Data source: CIE modelling

Table 4.17 reports the industry's contribution to regional employment in 2029-30.

4.17 Contribution to regional employment in 2029-30 under the Central scenario

	Direct	Indirect	Total
	FTE	FTE	FTE
New South Wales and ACT			
Coffs Harbour - Grafton	2,367	316	2,684
Richmond - Tweed	1,767	367	2,134
Riverina	2,660	503	3,163
Murray	1,755	301	2,056
Sydney	4,059	1,198	5,257
Rest of NSW/ACT	2,880	660	3,540
NSW/ACT total	15,489	3,345	18,834
Victoria			
North West	8,128	1,162	9,290
Shepparton	4,142	1,098	5,240
Melbourne	6,822	1,989	8,811
Rest of Victoria	5,144	1,192	6,336
Victoria total	24,236	5,441	29,677
Queensland			
Cairns	3,450	537	3,987
Wide Bay	4,645	750	5,394
Moreton Bay	1,364	331	1,695
Brisbane	1,066	461	1,527
TIDD-M	3,849	803	4,652
Rest of Queensland	5,659	1,302	6,961

	Direct	Indirect	Total
	FTE	FTE	FTE
Queensland total	20,034	4,183	24,217
South Australia			
South Australia - South East	4,198	1,252	5,451
Adelaide	2,305	970	3,275
Rest of SA	401	109	510
SA total	6,904	2,331	9,235
Western Australia			
Perth	1,733	608	2,340
Bunbury	1,719	524	2,242
Rest of WA	1,560	414	1,974
WA total	5,011	1,545	6,556
Tasmania			
West and North West	1,610	364	1,973
Rest of Tasmania	2,311	614	2,924
Tasmania total	3,920	977	4,898
Northern Territory			
NT	778	92	870
Australia	76,372	17,914	94,286

Source: CIE modelling

5 Horticulture industry in case study regions

Coffs Harbour – Grafton

Coffs Harbour and Grafton region is defined by the ABS SA4 104 (Coffs Harbour – Grafton) in New South Wales. Chart 5.1 is a map of the region.

5.1 Coffs Harbour – Grafton region



Data source: CIE

Key points for the region:

- The region had a population of 144 385 with a gross regional product (GRP) of \$9.65 billion in 2020-21.
- The total value of horticulture industry was \$441 million in 2020-21, with a value added of \$349 million (3.61 per cent of GRP) and employment of 2 262 FTEs (3.93 per cent of regional employment).
- Berries (blueberries and Rubus berries) production is the most significant horticulture sector in the region, accounting for about 88 per cent of horticulture growing (excluding processing) or 81 per cent of total horticulture (including processing) in the region. The region produces more than half of the nation's berry production.

- The horticulture industry in the region contributed directly \$349 million to the GRP and induced another \$85.8 million in GRP in 2020-21.
- The direct employment of the industry was 2 262 FTEs, with another indirect employment of about 261 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 18 per cent to \$522 million by 2029-30 under the Central scenario, with a range from \$476 million under the Low scenario to \$569 million under the High scenario.
 - Future growth could be further enhanced if export market will be developed. Currently the horticulture sector in the region is dominated by berry production which is mainly for domestic consumption and has limited future growth.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$468-550 million by 2029-30 while total employment contribution to be 2 531 to 2 856 FTEs.

Regional overview

Coffs Harbour – Grafton has a labour force of more than 63,000 people, with 60,816 being employed by April 2022, marking a low unemployment rate of only 3.6 per cent (table 5.2).

5.2 Population and labour force in Coffs Harbour – Grafton

	Population	Labour force	Participation rate	Employment	Unemployment rate
	persons	persons	%	persons	%
2020 ^a	142,579	60,907	52.1	51,127	16.1
2021 ^a	144,385	59,802	51.3	56,819	5.0
2022 ^b		63,071	53.9	60,816	3.6

^a In June of the year; ^b in April of the year

Source: ABS Cate.No.3812.0 and 6291.0.55.001

Regional economic structure

Economic structure

Table 5.3 reports the economic structure of Coffs Harbour – Grafton region in 2020-21 by broad economic sectors.

The region has a GRP of \$9.65 billion and total employment of about 57 545 FTEs. The most significant sector is other services, accounting for over 60 per cent of the region's GRP and employment.

Horticulture growing accounts for 3.53 per cent of the GRP or 3.80 per cent of employment, while horticulture processing making up about 0.1 per cent of GRP and employment.

5.3 Economic structure in Coffs Harbour – Grafton, 2020-21

	Value added		Employment	
	\$m	%	FTE	%
Horticulture growing	340.60	3.53	2,187	3.80
Other agriculture	105.59	1.09	1,849	3.21
Mining	36.22	0.38	155	0.27
Horticulture processing	8.18	0.08	76	0.13
Other manufacturing	393.33	4.08	2,509	4.36
Utilities	143.12	1.48	350	0.61
Construction	945.44	9.80	6,762	11.75
Trade	860.57	8.92	6,903	12.00
Transport	348.64	3.61	1,911	3.32
Other services	6,469.95	67.03	34,843	60.55
Total	9,651.65	100.00	57,545	100.00

Source: CIE estimates

Horticulture industry

Total horticulture production value in Coffs Harbour – Grafton was \$441 million in 2020-21, with a value added of \$348.8 million and employing 2 262 FTEs. Blueberries and Rubus berry are the predominant commodities with a GVP of \$356.8 million which accounts for 88 per cent of horticulture growing production (excluding horticulture processing) or 81 per cent of total horticulture production (including processing) in the region (table 5.4).

The region produces more than half of the nation's berry production.

5.4 Horticulture industry in Coffs Harbour – Grafton, 2020-21

	GVP		Value added		Employment	
	\$m	%	\$m	%	FTE	%
Blueberries and Rubus berries	356.8	80.8	312.0	89.5	1,987	87.8
Other fruit	17.8	4.0	10.6	3.1	70	3.1
Nuts	5.4	1.2	3.6	1.0	20	0.9
Vegetables	12.6	2.8	6.0	1.7	57	2.5
Nursery	12.9	2.9	8.3	2.4	53	2.3
Total horticulture farming	405.4	91.9	340.6	97.7	2,187	96.7
Processing	36.0	8.1	8.2	2.3	76	3.3
Total horticulture	441.4	100.0	348.8	100.0	2,262	100.0

Source: CIE estimates

Current horticulture contribution

It is estimated that the horticulture industry in Coffs Harbour – Grafton induced additional value added of \$85.8 million and employment of 261 FTEs, making a total

contribution of \$434.6 million to GRP and 2 523 FTEs to regional employment (table 5.5).

5.5 Estimated horticulture contribution in Coffs Harbour – Grafton, 2020-21

	GRP	Employment
	\$m	FTE
Direct	348.8	2,262
Indirect	85.8	261
Total	434.6	2,523

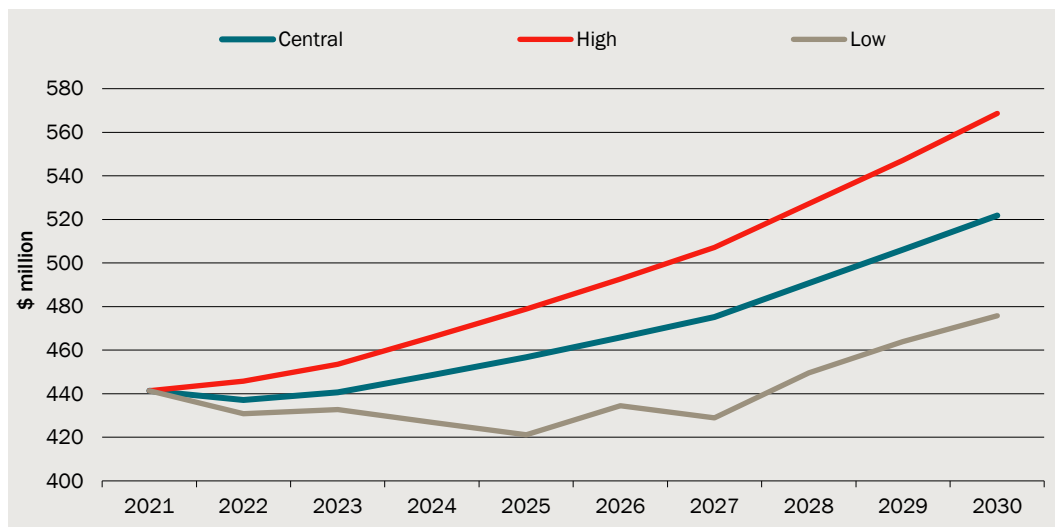
Source: CIE estimates

Regional outlook

Projections

It is projected that the horticulture GVP will reach \$521.8 million in Coffs Harbour – Grafton by 2030, representing an increase of 18.2 per cent from the value in 2020-21 under the Central scenario (teal line in chart 5.6).

5.6 Projected horticulture GVP in Coffs Harbour – Grafton



Data source: CIE modelling

The High and Low scenarios will see the GVP deviate by around 9 per cent from the Central level, reaching \$569 million and \$476 million, respectively, by 2029-30.

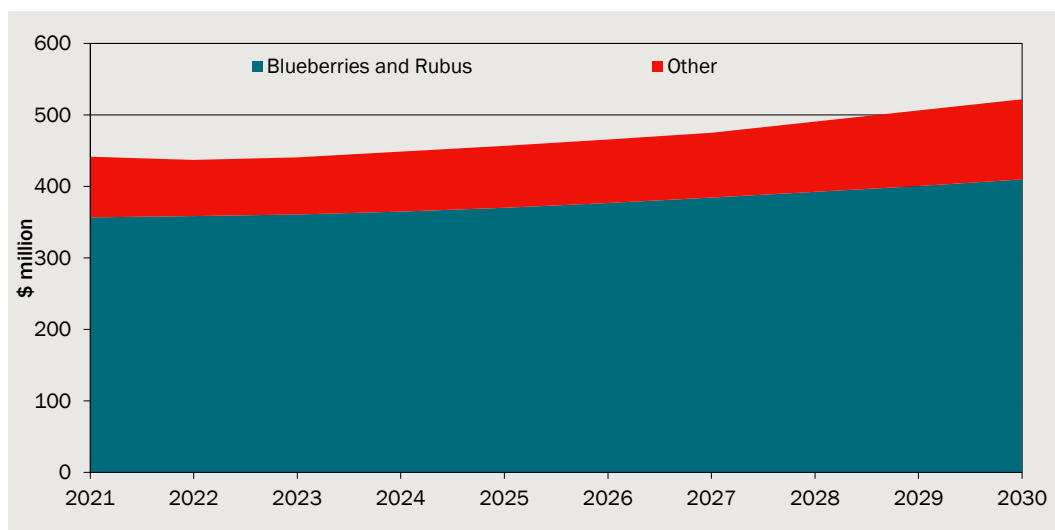
Berries production in the region is projected to grow by 14.8 per cent to \$410 million by 2030, slower than the overall growth in the horticulture sector in the region, and the share will fall from 81 per cent to 79 per cent of total horticulture GVP by 2029-30 under the Central scenario (chart 5.7).

This is because blueberries and Rubus berries are currently for domestic consumption, with virtually no exports in existence (some 0.1 per cent is exported). Blueberries and

Rubus berries have been the fastest growing fruit category to date. However, some saturation may emerge for domestic market as the consumption of food is limited by population growth.

The above discussion also suggests that developing the export market may provide further growth potential for the industry.

5.7 Central case projection for Coffs Harbour – Grafton



Data source: CIE modelling

Future contributions

By 2029-30, it is projected that the horticulture industry will induce additional value added by \$93 million to \$112 million, making the total contribution of \$468 million to \$550 million to GRP, depending on the assumptions under different scenarios (table 5.8).

Induced employment will be 283 to 349 FTEs, depending on the scenarios.

5.8 Projected horticulture contribution in Coffs Harbour – Grafton in 2029-30

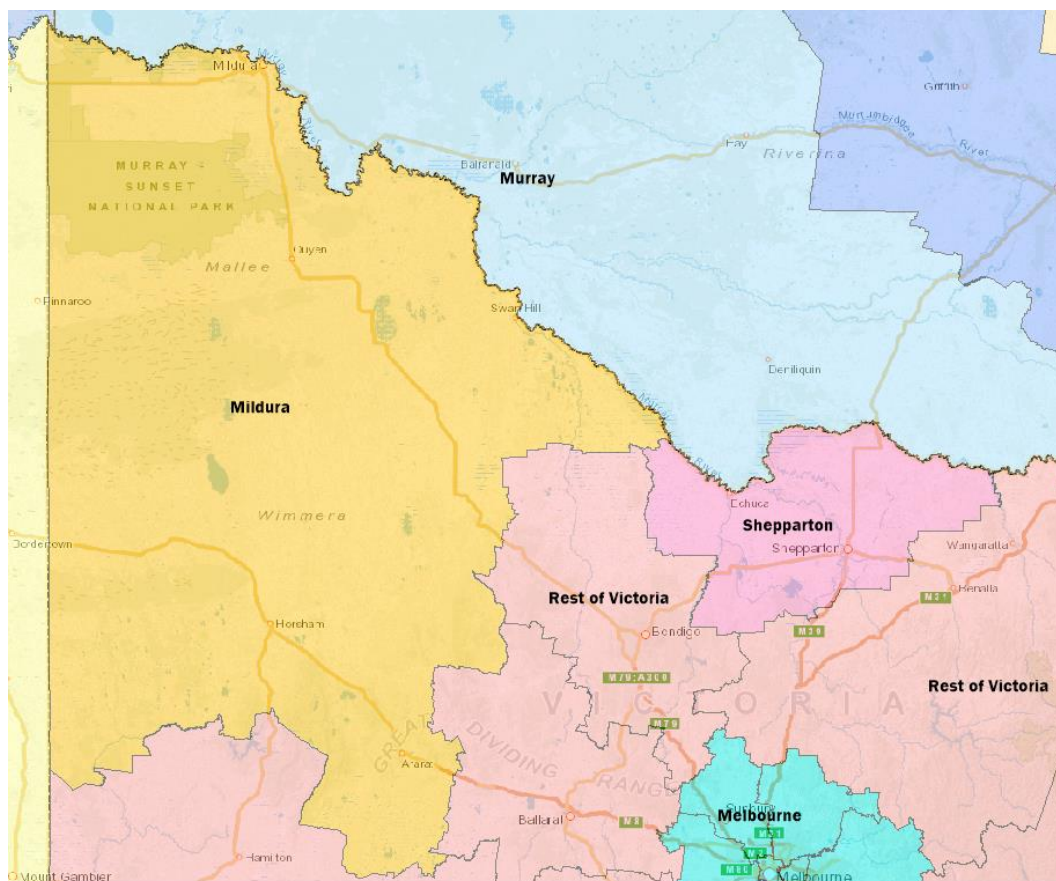
	Direct	Indirect	Total
GRP (\$ million)			
Central	405.7	102.5	508.1
High	437.8	112.1	550.0
Low	374.9	92.7	467.7
Employment (FTE)			
Central	2,367	316	2,684
High	2,507	349	2,856
Low	2,248	283	2,531

Source: CIE modelling

Mildura

Mildura is defined by ABS SA4 215 (Victoria – North West). As suggested by the name, the region is located in the state’s north west, bordering New South Wales and South Australia (chart 5.9).

5.9 Mildura region



Data source: CIE

As a region bordering Murray region in NSW, some horticulture products produced across the river in NSW would enter into the region, and vice versa, which would impact the region in terms of the processing, and other broader sectors such as transport and trade.

Key points for the region of Mildura:

- The region had a population of 150 795 with a gross regional product (GRP) of \$10.6 billion in 2021.
- Horticulture is a significant industry in the region. The total value of horticulture industry was \$1.7 billion in 2020-21, with a value added of \$1.1 billion (10.1 per cent of GRP) and employment of 6 932 FTEs (9.3 per cent of regional employment).
- Table grapes and almonds are the top two horticulture crops in the region, accounting for 29 per cent and 27 per cent, respectively, of the horticulture industry’s GVP.

- The region produces 78 per cent of the nation’s table grapes and 62 per cent of the nation’s almond production.
- The horticulture industry in the region contributed directly \$1.1 billion to the GRP and induced another \$201 million in GRP in 2020-21.
- The direct employment of the industry was 6 932 FTEs, with another indirect employment of about 907 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 32 per cent to \$2.2 billion by 2029-30 under the Central scenario, with a range from \$1.7 billion under the Low scenario to \$3.3 billion under the High scenario.
 - The projection demonstrates the importance of export market. The region’s major horticulture crops – table grapes (with an export share of 60 per cent) and almonds (with an export share of 75 per cent) – are projected to have higher growth than the industry’s average.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$1.3-2.6 billion by 2029-30 while total employment contribution to be 7 757 to 13 525 FTEs.

Regional overview

Mildura has a labour force of about 79,150 people, with 76,317 being employed by April 2022, marking a low unemployment rate of only 3.6 per cent (table 5.10).

5.10 Population and labour force in Mildura

	Population	Labour force	Participation rate	Employment	Unemployment rate
	persons	persons	%	persons	%
2019 ^a	152,096	67,187	54.0	63,427	5.6
2020 ^a	152,163	73,238	58.8	68,996	5.8
2021 ^a	150,795	67,596	55.4	66,372	1.8
2022 ^b		79,148	66.0	76,317	3.6

^a In June of the year; ^b in April of the year

Source: ABS Cate.No.3812.0 and 6291.0.55.001

Regional economic structure

Economic structure

Table 5.11 reports the economic structure of Mildura region in 2020-21 by broad economic sectors.

The region has a GRP of \$10.6 billion and total employment of about 74 721 FTEs. The most significant sector is other services, accounting for 53.5 per cent of the region’s GRP and 48.5 per cent of employment.

Horticulture is also a significant industry in the region. Horticulture growing accounts for 10.0 per cent of the GRP or 9.1 per cent of employment, while horticulture processing making up about 0.1-0.2 per cent of GRP and employment.

5.11 Economic structure of Mildura, 2020-21

	Value added		Employment	
	\$m	%	FTE	%
Horticulture growing	1,061.06	10.02	6,808	9.11
Other agriculture	618.35	5.84	6,862	9.18
Mining	217.67	2.05	688	0.92
Horticulture processing	13.41	0.13	124	0.17
Other manufacturing	597.13	5.64	4,566	6.11
Utilities	278.52	2.63	741	0.99
Construction	693.02	6.54	7,501	10.04
Trade	1,049.58	9.91	8,231	11.01
Transport	399.61	3.77	2,933	3.93
Other services	5,664.78	53.48	36,269	48.54
Total	10,593.13	100.00	74,721	100.00

Source: CIE estimates

Horticulture industry

Table 5.12 reports the structure of the horticulture industry in the region, with significant horticulture commodities being separately listed.

5.12 Horticulture industry in Mildura, 2020-21

	GVP		Value added		Employment	
	\$m	%	\$m	%	FTE	%
Table grapes	492.6	29.2	306.1	28.5	2,515	36.3
Citrus	145.8	8.6	106.9	9.9	534	7.7
Summer fruit	96.3	5.7	65.6	6.1	199	2.9
Olives	71.3	4.2	57.9	5.4	284	4.1
Other fruit	43.4	2.6	28.1	2.6	206	3.0
Almonds	447.4	26.5	340.7	31.7	1,668	24.1
Other nuts	10.5	0.6	8.1	0.8	39	0.6
Vegetables	121.9	7.2	65.8	6.1	573	8.3
Nursery	133.2	7.9	81.8	7.6	790	11.4
Total horticulture farming	1,562.2	92.5	1,061.1	98.8	6,808	98.2
Horticulture processing	127.3	7.5	13.4	1.2	124	1.8
Total horticulture	1,689.5	100.0	1,074.5	100.0	6,932	100.0

Source: CIE estimates

Total horticulture production value in Mildura was \$1.69 billion in 2020-21, with a value added of \$1.07 billion and employing 6 932 FTEs.

Table grapes and almonds are the top two horticulture crops, accounting for 29 per cent and 27 per cent, respectively, of the industry's GVP. The region produces 78 per cent of the nation's table grapes, and 62 per cent of national almond production.

Other significant horticulture commodities in the region include citrus (mainly oranges and mandarins), accounting for 8.6 per cent of total horticulture GVP.

Current horticulture contribution

It is estimated that the horticulture industry in Mildura induced additional value added of \$201 million and employment of 907 FTEs, making a total contribution of \$1.28 billion to GRP and 7 839 FTEs to regional employment (table 5.13).

5.13 Horticulture industry contribution in Mildura, 2020-21

	GRP	Employment
	\$m	FTE
Direct	1,074.5	6,932
Indirect	201.3	907
Total	1,275.8	7,839

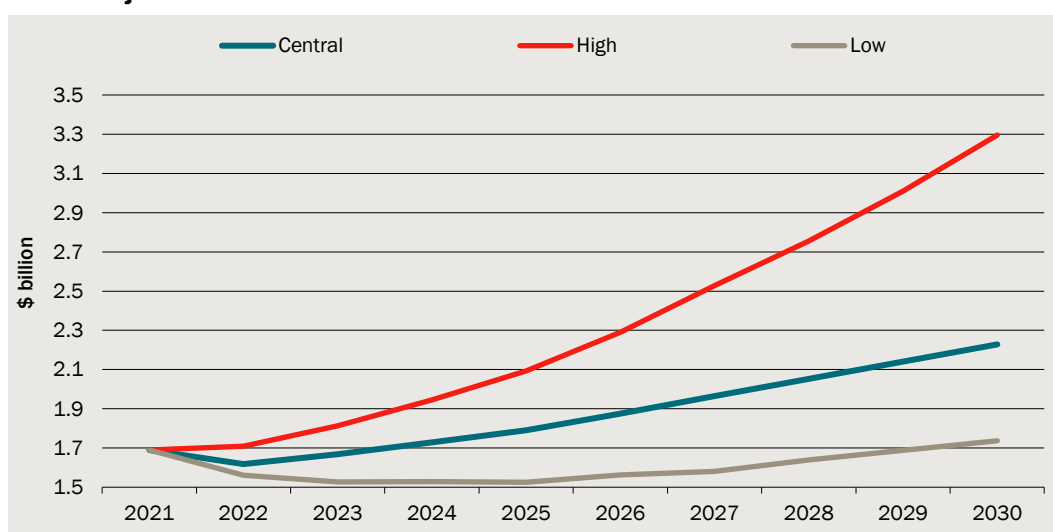
Source: CIE estimates

Regional outlook

Projected horticulture production

It is projected that the horticulture GVP will reach \$2.2 billion in Mildura by 2029-30, representing an increase of 31.9 per cent from the value in 2020-21 under the Central scenario (teal line in chart 5.14).

5.14 Projected horticulture GVP in Coffs Harbour – Mildura



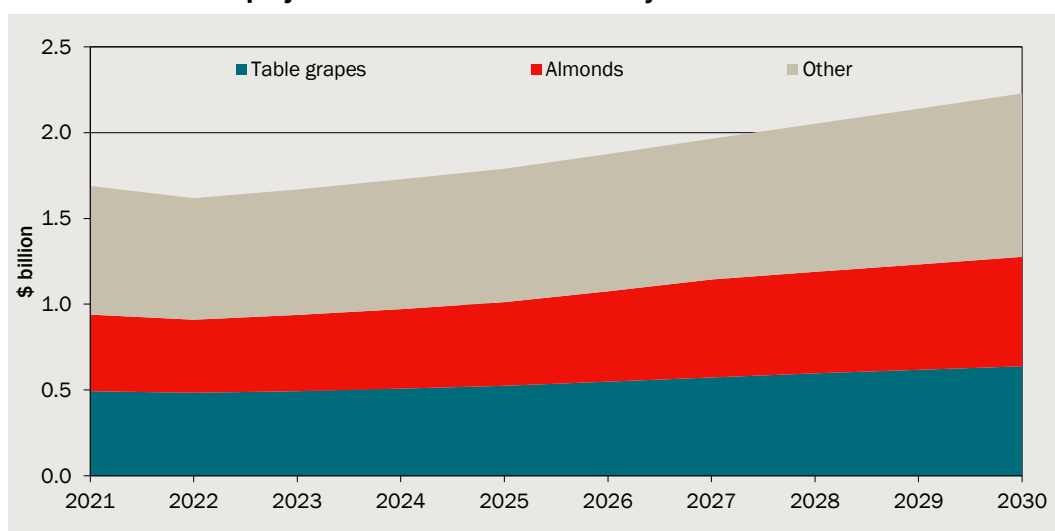
Data source: CIE modelling

The High and Low scenarios will see the GVP deviate by 48 per cent and 22 per cent from the Central level – reaching \$3.3 billion (red line) and \$1.7 billion (grey line), respectively, by 2029-30.

Table grapes production in the region is projected to grow by 30 per cent to \$638.7 million by 2029-30, while almonds will grow at a much faster pace, 42 per cent to \$637.2 million by 2029-30 under the Central scenario (chart 5.15). The share of the two commodities in total horticulture GVP in the region will therefore increase slightly from 56 per cent in 2020-21 to 57 per cent in 2029-30.

This is because both commodities have high export share, making it more responsive to economic conditions domestic and abroad.

5.15 Central case projection of horticulture industry in Mildura



Data source: CIE modelling

Future contributions

By 2029-30, it is projected that the horticulture industry will induce additional value added by \$207 million to \$379 million, making the total contribution of \$1.29 billion to \$2.59 billion to GRP, depending on the assumptions under different scenarios (table 5.16).

Induced employment will be 942 to 1 620 FTEs, depending on the scenarios.

5.16 Projected horticulture contribution in Mildura in 2029-30

	Direct	Indirect	Total
GRP (\$ million)			
Central	1,426.2	261.8	1,687.9
High	2,211.5	379.2	2,590.8
Low	1,081.7	207.1	1,288.8
Employment (FTE)			

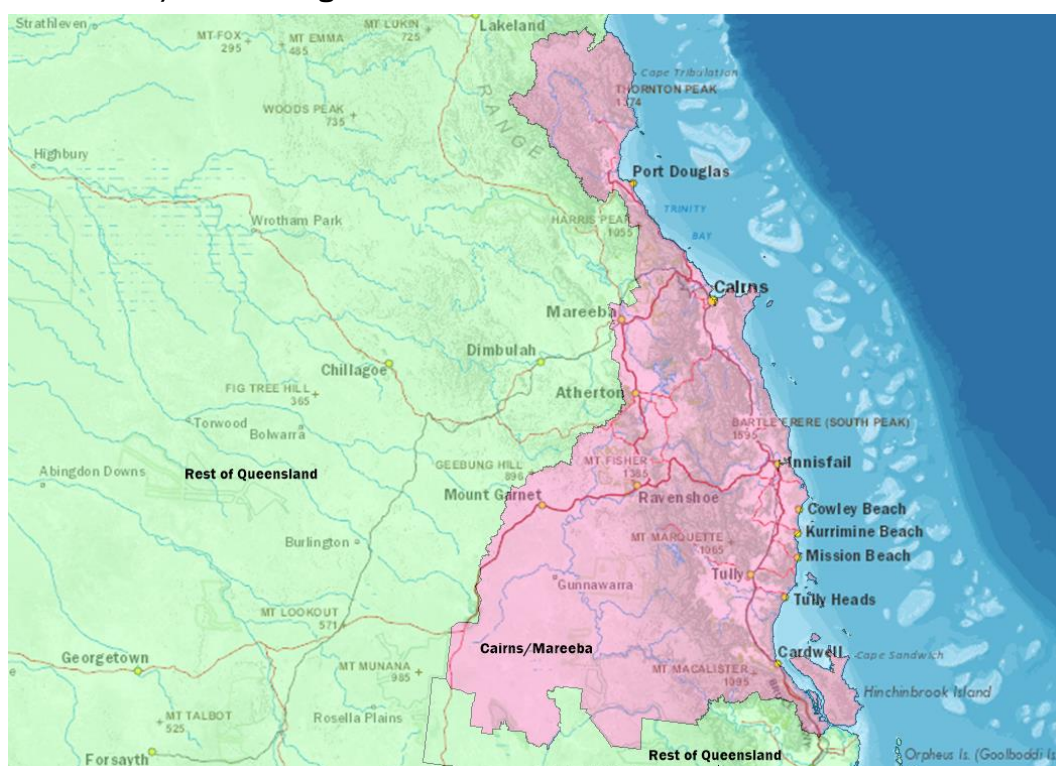
Central	8,128	1,162	9,290
High	11,905	1,620	13,525
Low	6,815	942	7,757

Source: CIE modelling

Cairns/Mareeba

Cairns/Mareeba is defined by ABS SA4 306 (Cairns). Chart 5.17 is a map of the region.

5.17 Cairns/Mareeba region



Data source: CIE

Key points for the region of Cairns/Mareeba:

- The region had a population of 256 645 with a gross regional product (GRP) of \$16.2 billion in 2020-21.
- The total value of horticulture industry was \$863 million in 2020-21, with a value added of \$515 million (3.2 per cent of GRP) and employment of 3 253 FTEs (2.8 per cent of regional employment).
- Bananas is the major horticultural commodity in the region, accounting for 60 per cent of total value of horticulture.
 - The region produces 86 per cent of the nation's total banana production.
- The horticulture industry in the region contributed directly \$515 million to the GRP and induced another \$82.2 million in GRP in 2020-21.

- The direct employment of the industry was 3 253 FTEs, with another indirect employment of about 461 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 26 per cent to \$1 billion by 2029-30 under the Central scenario, with a range from \$941 million under the Low scenario to \$1.1 billion under the High scenario.
 - Future growth could be further enhanced if export market will be developed. Currently the horticulture sector in the region is dominated by banana production which is virtually fully for domestic consumption, limiting future growth.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$650-749 million by 2029-30 while total employment contribution to be 3 780 to 4 210 FTEs.

Regional overview

Cairns has a labour force of more than 145 880 people, with 135 684 being employed by April 2022, marking a relatively high unemployment rate of 7 per cent (table 5.18).

5.18 Population and labour force in Cairns

	Population	Labour force	Participation rate	Employment	Unemployment rate
	persons	persons	%	persons	%
2019 ^a	253,818	137,952	68.0	132,271	4.1
2020 ^a	255,995	136,710	66.7	126,327	7.6
2021 ^a	256,645	131,094	63.7	122,142	6.8
2022 ^b		145,882	70.4	135,684	7.0

^a In June of the year; ^b in April of the year

Source: ABS Cate.No.3812.0 and 6291.0.55.001

Regional economic structure

Economic structure

Table 5.19 reports the economic structure of Cairns/Mareeba region in 2020-21 by broad economic sectors.

The region had a GRP of \$16.2 billion and total employment of about 116 706 FTEs in 2020-21. The most significant sector is other services, accounting for about 65 per cent of the region's GRP and 62 per cent of employment.

Horticulture accounts for 3.2 per cent of the GRP or 2.8 per cent of regional employment.

5.19 Economic structure of Cairns/Mareeba, 2020-21

	Value added		Employment	
	\$m	%	FTE	%
Horticulture growing	512.36	3.15	3,229	2.77
Other agriculture	421.98	2.60	3,679	3.15
Mining	210.56	1.30	796	0.68
Horticulture processing	2.61	0.02	24	0.02
Other manufacturing	764.86	4.71	5,477	4.69
Utilities	434.02	2.67	1,043	0.89
Construction	1,193.64	7.35	10,605	9.09
Trade	1,393.56	8.58	13,054	11.18
Transport	904.51	5.57	6,764	5.80
Other services	10,403.24	64.05	72,035	61.72
Total	16,241.36	100.00	116,706	100.00

Source: CIE estimates

Horticulture industry

Table 5.20 reports the horticulture industry in the region in 2020-21.

Total horticulture production value in Cairns was \$862.7 million in 2020-21, with a value added of \$515.0 million and employment of 3,253 FTEs.

Bananas is the top horticulture crop, accounting for 60 per cent of the region's horticulture industry GVP. The region produces 86 per cent of the nation's total banana production.

Avocados is also a significant commodity, accounting for 13 per cent of the region's horticulture industry GVP.

5.20 Horticulture industry in Cairns, 2020-21

	GVP		Value added		Employment	
	\$m	%	\$m	%	FTE	%
Bananas	514.4	59.6	311.0	60.4	1,918	59.0
Avocados	113.9	13.2	62.6	12.1	425	13.1
Other fruit	78.4	9.1	49.4	9.6	320	9.8
Vegetables	35.7	4.1	18.8	3.6	161	5.0
Nursery	108.9	12.6	70.7	13.7	405	12.4
Total horticulture farming	851.2	98.7	512.4	99.5	3,229	99.3
Processing	11.5	1.3	2.6	0.5	24	0.7
Total horticulture	862.7	100.0	515.0	100.0	3,253	100.0

Source: CIE estimates

Current horticulture contribution

It is estimated that the horticulture industry in Cairns induced additional value added of \$82.2 million and employment of 461 FTEs, making a total contribution of \$597 million to GRP and 3 714 FTEs to regional employment (table 5.21).

5.21 Horticulture industry contribution in Cairns, 2020-21

	GRP	Employment
	\$m	FTE
Direct	515.0	3,253
Indirect	82.2	461
Total	597.2	3,714

Source: CIE estimates

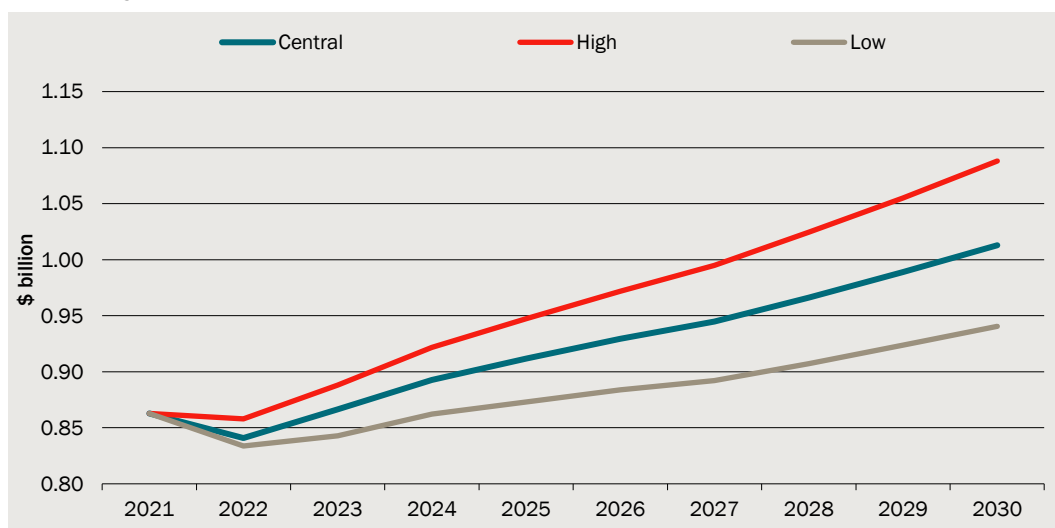
Regional outlook

Projected horticulture production

It is projected that the horticulture GVP will reach \$1 billion in Cairns by 2029-30, representing an increase of 17.4 per cent from the value in 2020-21 under the Central scenario (teal line in chart 5.22).

The High and Low scenarios will see the GVP deviate by 7 per cent from the Central level – reaching \$941 million (grey line) and \$1.1 billion (red line), respectively, by 2029-30.

5.22 Projected horticulture GVP in Cairns



Data source: CIE modelling

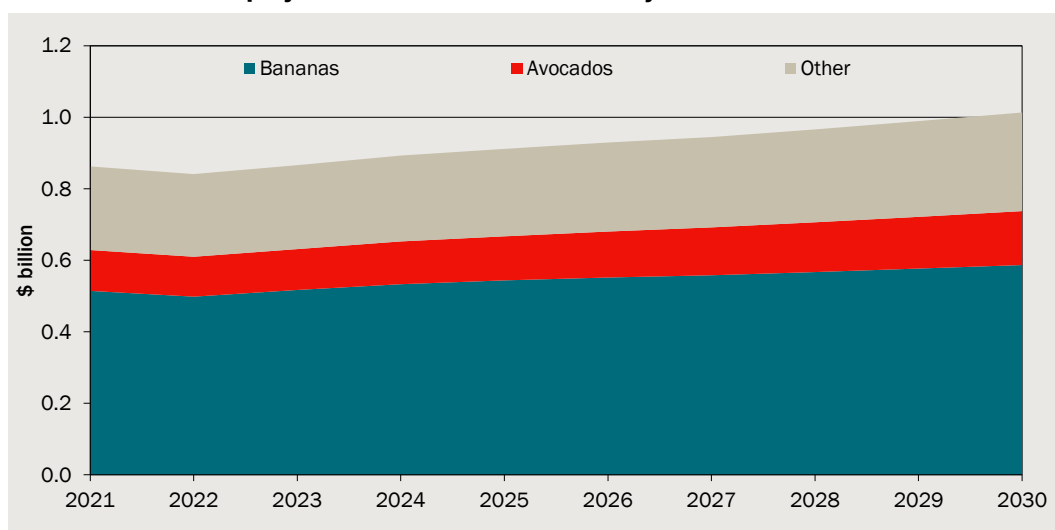
Bananas in the region is projected to grow by 14 per cent to \$586.6 million by 2029-30, slower than the overall growth in the horticulture sector, making it slightly less important

– the share will fall from 60 per cent to 58 per cent of total horticulture GVP by 2029-30 under the Central scenario (chart 5.23).

This is because bananas are for domestic consumption, with no exports in existence. As discussed above, domestic consumption of food is limited by population growth.

Avocados in the region is projected to grow by 33 per cent to \$151.4 million by 2029-30. The growth is higher than the regional average, and thus its share will increase from current 13 per cent to 15 per cent in 2029-30.

5.23 Central case projection of horticulture industry in Cairns



Data source: CIE modelling

Future contributions

By 2029-30, it is projected that the horticulture industry will induce additional value added by \$89.5 million to \$102.8 million, making the total contribution of \$650 million to \$749.3 million to GRP, depending on the assumptions under different scenarios (table 5.24).

5.24 Projected horticulture contribution in Cairns in 2030

	Direct	Indirect	Total
GRP (\$ million)			
Central	602.7	96.0	698.7
High	646.5	102.8	749.3
Low	560.5	89.5	650.0
Employment (FTE)			
Central	3,450	537	3,987
High	3,635	575	4,210
Low	3,278	502	3,780

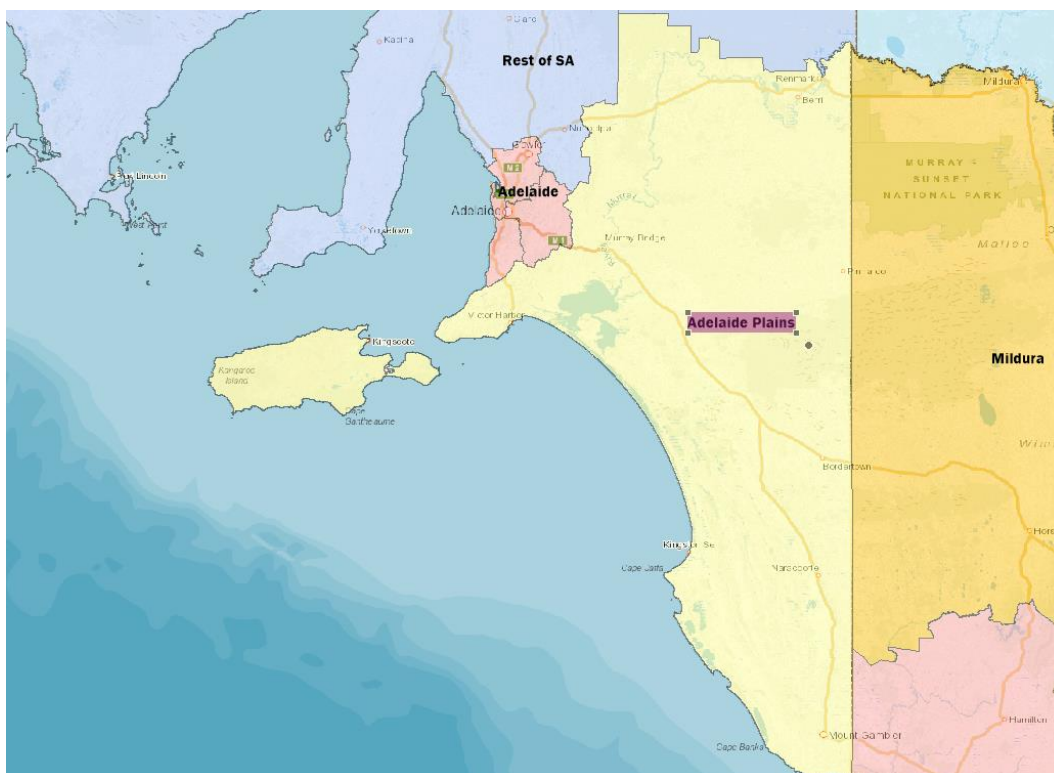
Source: CIE modelling

Induced employment will be 502 to 575 FTEs, depending on the scenarios.

Adelaide Plains

Adelaide Plains is defined by ABS SA4 407 (South Australia – South East). As the SA4 name suggests, it is located in the south east of South Australia, bordering Victoria (chart 5.25).

5.25 Adelaide Plains region



Data source: CIE

Key points for the region of Adelaide Plains:

- The region had a population of 195 942 with a gross regional product (GRP) of \$11.2 billion in 2020-21.
- The total value of horticulture industry was \$941.5 million in 2020-21, with a value added of \$587.9 million (5.2 per cent of GRP) and employment of 3 649 FTEs (4.5 per cent of regional employment).
- Citrus, potatoes, and almonds are the major horticultural commodities in the region, accounting for 23.2 per cent, 22.5 per cent, and 15 per cent, respectively, of the region's horticulture GVP.
 - Onion is also significant, accounting for 10.2 per cent of the region's horticulture GVP, and the region produces almost half of the nation's total onion production.
- The horticulture industry in the region contributed directly \$587.9 million to the GRP and induced another \$170.3 million in GRP in 2020-21.

- The direct employment of the industry was 3 649 FTEs, with another indirect employment of about 1 002 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 29 per cent to \$1.2 billion by 2029-30 under the Central scenario, with a range from \$1.0 billion under the Low scenario to \$1.6 billion under the High scenario.
- Total (direct and indirect) contribution of the industry to GRP is projected to be \$795 million to 1.3 billion by 2029-30 while total employment contribution to be 4 683 to 7 129 FTEs.

Regional overview

The region has a labour force of about 91 230 people, with 88 423 being employed by April 2022, marking a low unemployment rate of only 3.1 per cent (table 5.26).

5.26 Population and labour force in Adelaide Plains

	Population	Labour force	Participation rate	Employment	Unemployment rate
	persons	persons	%	persons	%
2019 ^a	193,316	97,163	60.5	90,603	6.8
2020 ^a	194,809	98,215	60.5	90,065	8.3
2021 ^a	195,942	91,828	56.4	88,641	3.5
2022 ^b		91,228	55.9	88,423	3.1

^a In June of the year; ^b in April of the year

Source: ABS Cate.No.3812.0 and 6291.0.55.001

Regional economic structure

Economic structure

Table 5.27 reports the economic structure of Adelaide Plains region in 2020-21 by broad economic sectors.

The region had a GRP of \$11.2 billion and total employment of about 80 664 FTEs in 2020-21. The most significant sector is other services, accounting for about 47 per cent of the region's GRP and 42 per cent of regional employment.

Agriculture is also important in this region. Horticulture growing accounts for 5.1 per cent of the GRP or 4.4 per cent of regional employment, while horticulture processing contributing to another 0.1 per cent of GRP or regional employment. Together with other agriculture, total agriculture contributes to over 20 per cent of the GRP or regional employment.

5.27 Economic structure of Adelaide Plains, 2020-21

	Value added		Employment	
	\$m	%	FTE	%
Horticulture growing	575.02	5.13	3,530	4.38
Other agriculture	1,991.02	17.75	14,434	17.89
Mining	90.96	0.81	352	0.44
Horticulture processing	12.93	0.12	119	0.15
Other manufacturing	891.48	7.95	7,785	9.65
Utilities	210.60	1.88	509	0.63
Construction	727.27	6.48	7,707	9.56
Trade	1,085.92	9.68	9,160	11.36
Transport	371.00	3.31	2,982	3.70
Other services	5,259.55	46.89	34,085	42.26
Total	11,215.75	100.00	80,664	100.00

Source: CIE estimates

Horticulture industry

Table 5.28 reports the structure of the horticulture industry in the region, with significant commodities being separately identified.

5.28 Horticulture industry in Adelaide Plains, 2020-21

	GVP		Value added		Employment	
	\$m	%	\$m	%	FTE	%
Citrus	218.8	23.2	161.2	27.4	802	22.0
Table grapes	24.5	2.6	15.2	2.6	125	3.4
Summer fruit	24.8	2.6	16.9	2.9	51	1.4
Apples	21.1	2.2	16.5	2.8	62	1.7
Olives	15.2	1.6	12.4	2.1	61	1.7
Other fruit	14.9	1.6	9.8	1.7	55	1.5
Almonds	140.9	15.0	107.3	18.2	525	14.4
Other nuts	7.3	0.8	5.6	1.0	27	0.7
Potatoes	211.5	22.5	125.8	21.4	956	26.2
Onions	96.1	10.2	50.0	8.5	434	11.9
Carrots	31.1	3.3	15.2	2.6	141	3.9
Other vegetables	20.4	2.2	10.2	1.7	92	2.5
Nursery	43.5	4.6	29.0	4.9	197	5.4
Total farming	870.0	92.4	575.0	97.8	3,530	96.7
Processing	71.4	7.6	12.9	2.2	119	3.3
Total horticulture	941.5	100.0	587.9	100.0	3,649	100.0

Source: CIE estimates

Total horticulture production value in Adelaide Plains was \$941.5 million in 2020-21, with a value added of \$587.9 million and an employment of 3 649 FTEs.

Citrus, almonds, potatoes and onions are the top horticulture crops, accounting for 23 per cent, 15 per cent, 23 per cent and 10 per cent, respectively, of the industry’s GVP. The region produces about a quarter of the nation’s citrus, 20 per cent of national almonds, 26 per cent of national potatoes production, and 47 per cent of national onions production.

Current horticulture contribution

It is estimated that the horticulture industry in Adelaide Plains induced additional value added of \$170.3 million and employment of 1 002 FTEs, making a total contribution of \$758.2 million to GRP and 4 651 FTEs to regional employment (table 5.29).

5.29 Horticulture industry contribution in Adelaide Plains, 2020-21

	GRP	Employment
	\$m	FTE
Direct	587.9	3,649
Indirect	170.3	1,002
Total	758.2	4,651

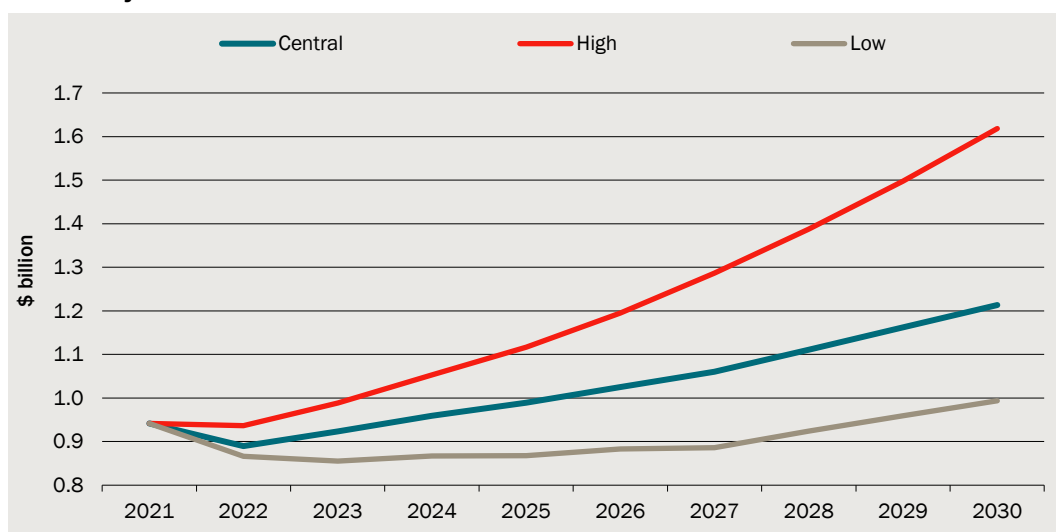
Source: CIE estimates

Regional outlook

Projected horticulture production

It is projected that the horticulture GVP in Adelaide Plains will reach \$1.2 billion by 2029-30, representing an increase of 28.9 per cent from the value in 2020-21 under the Central scenario (teal line in chart 5.30).

5.30 Projected horticulture GVP in Adelaide Plains

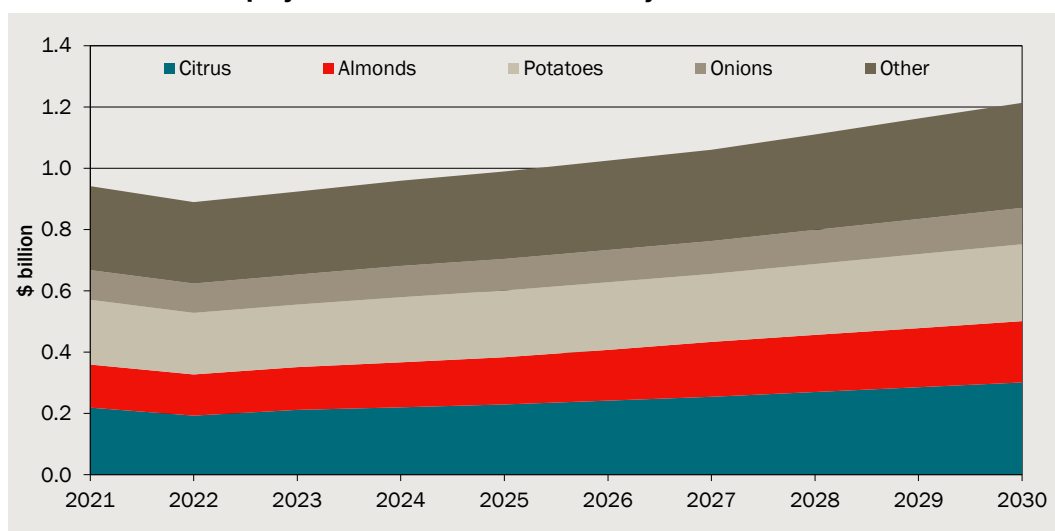


Data source: CIE modelling

The High and Low scenarios will see the GVP deviate by 33 per cent and 18 per cent, respectively, from the Central level – reaching \$1.6 billion and \$1 billion by 2030.

Chart 5.31 shows the projected horticulture GVP under the Central scenario.

5.31 Central case projection of horticulture industry in Adelaide Plains



Data source: CIE modelling

Citrus production in the region is projected to grow by 37.3 per cent to \$300.5 million by 2029-30 and almonds by 42.4 per cent to \$200.6 million, both presenting higher than average horticulture growth in the region.

On the other hand, potatoes and onions production is projected to grow by lower than regional average growth, being 18.6 per cent and 24.2 per cent, respectively, to reach \$250.9 million and \$119.3 million by 2029-30.

This is also because of the differences in export shares. Both citrus and almonds have high export share while 97 per cent of potatoes and 85 per cent of onions are for domestic use. As discussed above, domestic consumption of food is limited by population growth.

Future contributions

By 2029-30, it is projected that the horticulture industry in Adelaide Plains will induce additional value added by \$181.5 million to \$269.4 million, making the total contribution of \$795.3 million to \$1.32 billion to GRP, depending on the assumptions under different scenarios (table 5.32).

Induced employment in 2029-30 will be between 1 073 and 1 535 FTEs, depending on the scenarios.

5.32 Projected horticulture contribution in Adelaide Plains in 2029-30

	Direct	Indirect	Total
GRP (\$ million)			
Central	762.7	214.4	977.1
High	1,054.0	269.4	1,323.4
Low	613.7	181.5	795.3
Employment (FTE)			
Central	4,198	1,252	5,451
High	5,594	1,535	7,129
Low	3,610	1,073	4,683

Source: CIE modelling

A Models used

A suite of models have been used in this study

- FP model – a general equilibrium model of the Australian economies with a focus on agriculture and food processing;
- HI_LINK – a detailed Australian horticulture industry value chain model; and
- Regional module – a model with detailed regional economic structure to estimate the regional impacts in accordance with the national and state-level results..

This appendix gives a more detailed description of these models.

FP model

The CIE FP model is a special version of the CIE's original inhouse CGE model of the Australian economies, CIE-REGIONS. It was first developed by the CIE for the CSIRO to evaluate its agriculture research.²⁶

For the FP model considerable effort was put into restructuring the commodities and sectors in the original CIE-REGIONS model. More specifically, the previous broad on-farm sectors are split into 10 more specific ones, and the single food, beverage and tobacco sector in the original version is split into 11 more specific ones. Consequently, other manufacturing and services sectors are aggregated. As a result, the existing version of the food processing model identifies 38 sectors (table A.1).

A.1 Sectors identified by the FP model

Farming	Food manufacturing	Other
Cattle	Beef	Mining
Sheep	Sheepmeat	Wood and paper products and printing
Dairy cattle	Dairy products – fresh	Petrol products
Other animal	Dairy products – manufactured	Chemicals
Wheat	Flour, confectionary and biscuit	Other manufacturing
Oilseed	Oil and fat	Electricity generation
Other grains	Juice	Electricity distribution

²⁶ Borrell, B., T. Jiang, D. Pearce and I. Gould 2014, 'Payoffs from research and development along the Australian food value chain: A general equilibrium analysis', *Australian Journal of Agricultural and Resource Economics*, 58(3), pp409-29.

Farming	Food manufacturing	Other
Fruits and nuts	Fruit products	Gas
Vegetables	Vegetable products	Water
Other crops	Other food manufacturing	Construction
Forestry	Beverage and tobacco	Wholesale trade
Fishing		Retail trade
		Transport
		Services
		Ownership of dwellings

Source: CIE FPM database

With this detailed treatment of agriculture and food processing industries, the model is able to evaluate the changes, e.g. productivity improvement and/or demand preference shift induced by R&D and policy interventions, at any point of the food value chain.

Despite the difference in sectoral classification, the other properties of the FP model are the same as the CIE-REGIONS model. Some key aspects of this model are that it:

- provides a detailed account of industry activity, investment, imports, exports, changes in prices, employment, household spending and savings and many other factors;
 - identifies 38 industries and commodities (table A.1);
 - identifies the major sectors of the food industry in Australia in considerable detail;
- accounts for Australia's six states and two territories as distinct regions including specific details about the budgetary revenues and expenditures of each of the eight state and territory governments and the Australian Government (the government finances in CIE-REGIONS align as closely as practicable to the ABS government finance data);
- includes a detailed treatment of the fiscal effects of the Goods and Services Tax (GST);
- specifically accounts for major taxes;
- traces out the impact of transfers between governments;
- accounts for differing economic fundamentals in the states (for instance, agricultural industries in general and dairy industry in particular in Victoria, the mining boom in WA and Queensland);
- can produce results on employment and value added at a regional level; and
- can be run in a static or dynamic mode.

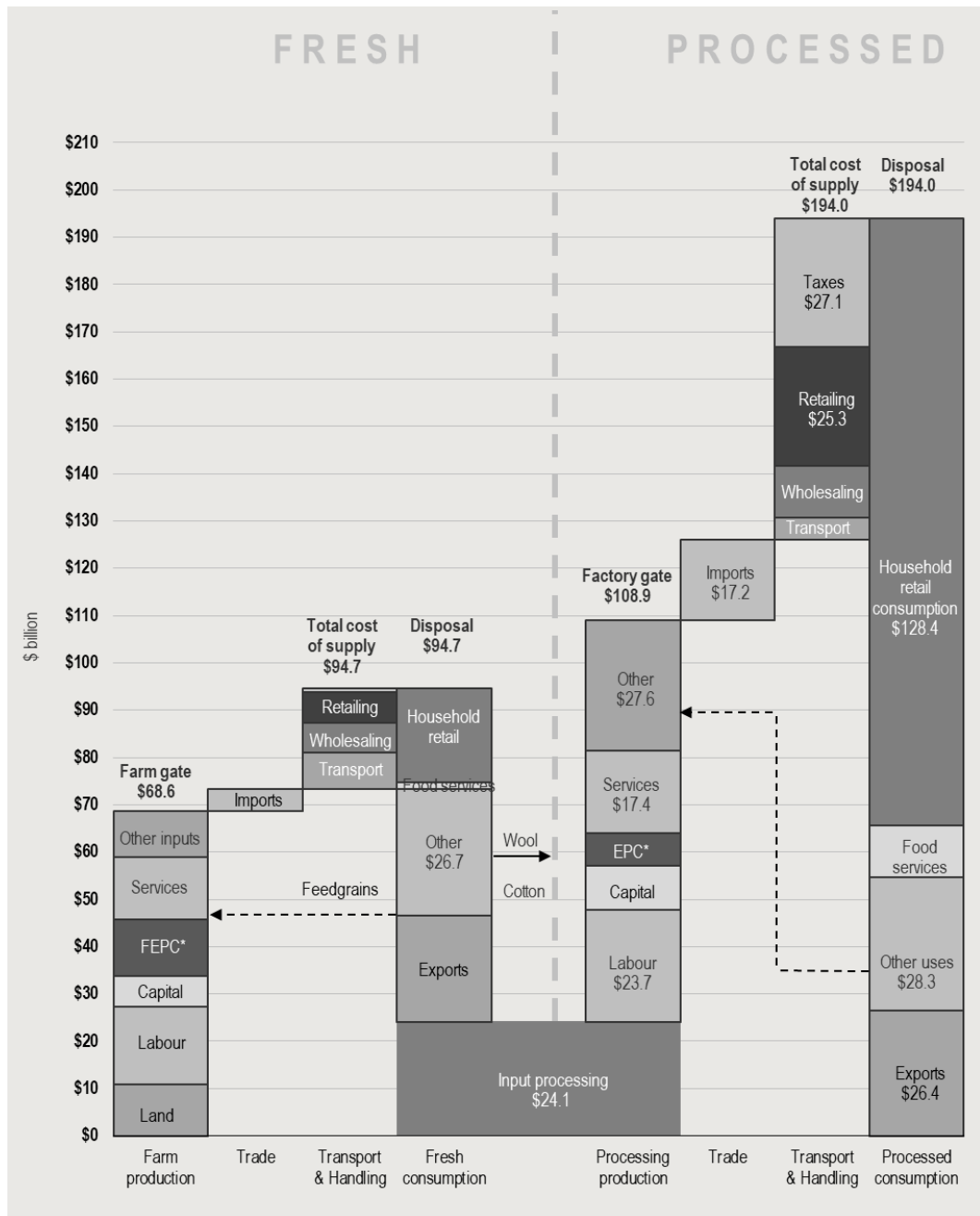
The dynamic mode of the model allows analysis to trace impacts over time as the economy adjusts, being particularly useful for producing projections over the medium to longer terms.

The value chain in the CIE FP model

A special feature of the CIE FP model is that it clearly identifies the value chain of the farming and food processing industries from raw inputs, to farm gate, through to processing, wholesale, retail and exports.

As an illustration, chart A.2 shows the linkages from the perspective of the total farming and food processing value chain in Australia contained in the CIE FP model.

A.2 Aggregate value chain for Australian agriculture and food processing



Note: FEPC*: feed, energy, packaging and chemicals; EPC*: energy, packaging and chemicals
 Data source: CIE Food Processing Model.

In chart A.2 the farm gate value of production is \$68.6 billion representing the value of primary factors (land, labour and capital), plus 38 intermediate inputs as shown in the 'farm production' column. In the model, production functions explain the demand for inputs given the costs of input, prices of outputs and the level of relative technical efficiency between inputs.

Imports and margin activities (retailing, wholesaling, transport and taxes) are added to the farm gate value to provide a wholesale and/or retail value of fresh produce worth around \$94.7 billion a year. Margin activities also use inputs and are represented by relevant production functions.

Some of the \$94.7 billion of agricultural output shown in the chart ('fresh consumption column) are consumed directly as fresh produce by Australian households, particularly fruit and vegetables. Household demand for each fresh agricultural product is represented as a function of prices, income and population. Some such as feed grains is recycled back to agriculture, and some is non-food, such as wool. About 24 per cent is exported unprocessed, such as wheat, determined by the domestic and world prices. And the rest, about 25 per cent, are used as inputs into food processing.

In addition to the fresh inputs, inputs from other industries as well as primary factors generate a factory gate value of \$108.9 billion of processed food products a year ('processed production' column).

Imports and other margin activities of transport, wholesaling, retailing and taxes are added to the \$108.9 billion to provide a retail and/or wholesale value of processed products of \$194 billion ('processed consumption' column).

About \$128.4 billion is purchased by households and food service outlets and restaurants in Australia. Some \$28.3 billion is recycled within the food processing sector, such as meat going into meat pies and cheese into pre-packed pizzas and other non-food sectors. And the rest (about 13.6 per cent) is exported.

HI_LINK model

While the CIE FP has a fairly detailed representation of the farming and food processing industries in Australia, its sectoral classification may be still highly aggregated. We used a detailed horticultural industry value chain model, HI_LINK, to supplement the CIE FP model.

The HI_LINK model is an economic model of the entire horticulture industry. It was initially developed by the CIE for Hort Innovation in 2008 for the development of horticultural industry strategy. The model distinguishes 48 commodities covering fresh, processed and amenity horticulture (table A.3).

A.3 Commodities and sectors identified in HI-LINK model

Commodity	Commodity	Commodity
Apples	Mangos	Capsicum and nec
Pears	Melons	Tomato for processing
Summer fruit	Other tropical fruits	Tomato for fresh use
Cherries	Olives	Asparagus
Strawberries	Macadamia	Mushrooms
Rubus	Almonds	Garlic and herbs
Kiwifruit	Other nuts	Other vegetables
Oranges	Potatoes	Nursery
Mandarins	Carrots	Turf
Other citrus	Onions	Cut flowers
Table grapes	Pumpkins	Frozen potato
Other grapes	Sweet corn	Canned tomato
Other temporal fruits	Pea and bean	Other processed vegetables
Bananas	Lettuce	Processed fruits and jams
Pineapples	Broccoli	Juice
Avocados	Cauliflower	Olive oil

Source: HI-LINK model database.

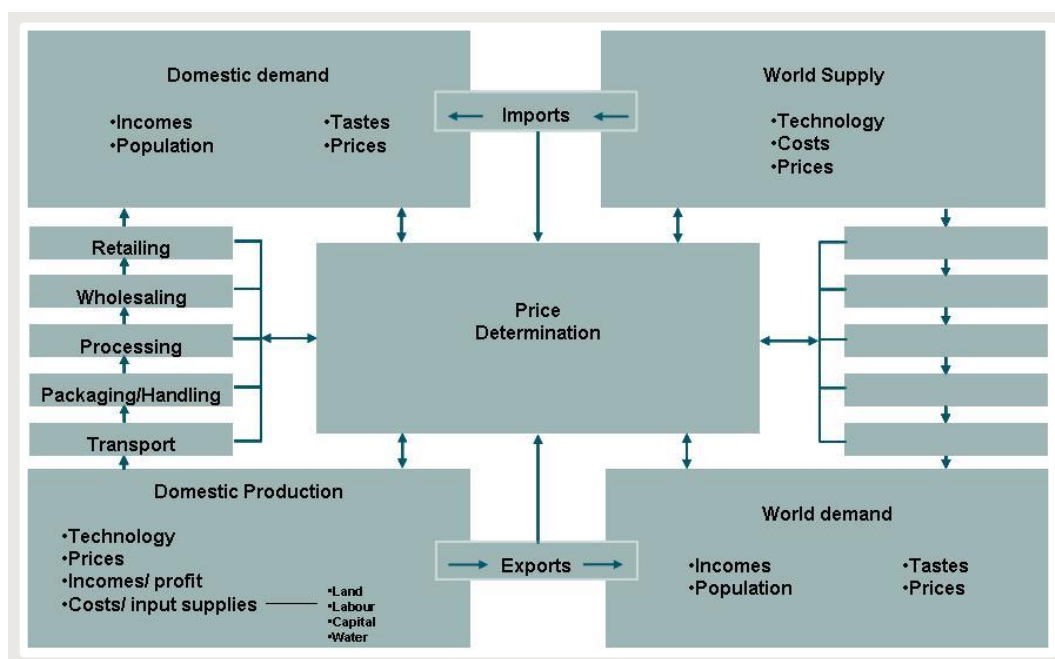
The model has a value-chain from farm gate to processing, and through to wholesale, retail and exports. Both supply and demand (including both domestic and international demands) are considered in the model (chart A.4).

Producers, wholesalers, processors and retailers all respond to maximise profits so that, if favourable changes are made to their industry that lifts returns and/or reduces costs, they will have an incentive to expand supply to the market. Where possible, switching to alternative products that are more profitable will occur.

Similarly, consumers respond to price through purchase behaviours. They substitute between foods (or products in the case of amenity horticulture) in response to changing prices. Most parameters for the model come from extensive estimation of degrees of responsiveness of sales to changes in price (elasticities) from retail scan data. Some are adopting estimates in the literature.

The HI_LINK model can be used for performing ‘what if’ type experiments (scenario simulations) so that potential payoffs to the entire industry can be assessed, such as what happens to industry profitability if demand could be increased by various amounts. Potential strategies and actions can then be appraised and priorities assigned to areas of highest payoff.

A.4 The structure of the HI-LINK model



Note: Linkages between world supply and demand are similar to those between domestic supply and demand and thus not explicitly specified at the right-hand side in the chart

Data source: HI-LINK model.

Commodity classification

Table A.5 summarises the commodity correspondence between HI_LINK model commodities and the commodities reported in the Australian Horticulture Statistical Handbook (AHSH) published by Hort Innovation. The Handbook reports horticulture growing (farming) only.

A.5 Commodity concordance

HI_LINK commodities	Corresponding Horticulture Statistical Handbook commodities
Fruit	
1 Apples	Apples
2 Pears and nashis	Pears; Nashi
3 Summer fruit	Apricots; Nectarines/Peaches; Plums
4 Cherries	Cherries
5 Strawberries	Strawberries
6 Blueberries and Rubus	Blueberries; Rubus Berries
7 Kiwi fruit	Kiwifruit
8 Oranges	Oranges
9 Mandarins	Mandarins

HI_LINK commodities	Corresponding Horticulture Statistical Handbook commodities
10 Other citrus	Grapefruit; Lemons/Limes
11 Grapes - Table and Other	Table Grapes
12 Grapes - Total Dried	Dried Grapes
13 Other temperate fruit	Persimmons; Other Fruit
14 Bananas	Bananas
15 Pineapples	Pineapples
16 Avocados	Avocados
17 Mangoes	Mangoes
18 Melons	Muskmelons; Watermelons
19 Other tropical fruit	Custard Apples; Lychees; Passionfruit; Papaya/Pawpaw
20 Olives	Olives under the processing fruit category
Nuts	
21 Macadamia	Macadamias
22 Almonds	Almonds
23 Other nuts	Chestnuts; Hazelnuts; Pecans; Pistachios; Walnuts; Other Nuts
Vegetables	
24 Potatoes	Potatoes
25 Carrots	Carrots
26 Onions	Onions
27 Pumpkins	Pumpkins
28 Sweet corn	Sweet Corn
29 Peas and beans	Peas; Beans
30 Lettuce	Head Lettuce
31 Broccoli	Broccoli/Baby Broccoli
32 Cauliflower	Cauliflower
33 Capsicums; Chillies & Peppers	Capsicums; Chillies
34 Tomatoes - processing	Tomatoes
35 Tomatoes - fresh	
36 Asparagus	Asparagus
37 Mushrooms	Mushrooms
38 Garlic and herbs	Garlic; Fennel; Parsley and Other Herbs

HI_LINK commodities	Corresponding Horticulture Statistical Handbook commodities
39 Other vegetables	Artichokes; Beetroot; Brussels Sprouts; Cabbage; Celery; Cucumbers; Eggplant; Eng.Spinach/Silverbeet/Kale; Ginger; Leafy Asian Vegetables; Leafy Salad Vegetables; Leeks; Parsnips; Sweetpotatoes; Zucchini; Other Vegetables
Nursery	
40 Nursery	Nursery
41 Cultivated turf	Turf
42 Cut flowers	Cut Flowers
Processing	
43 Frozen potatoes	
44 Canned tomatoes	
45 Other processed vegetables	
46 Processed fruits and jams	Prunes; Other Dried Tree Fruit; Canned Fruit
47 Orange and other juice	
48 Olive oil	Olives (not olive oil) are classified as a processing fruit (see commodity #20 above)

Source: CIE

Regional module

The regional module projects the national and state level results into regional levels. The module has equivalent sector classification as the FP model and HI_LINK model with more detailed regional coverage.

Regional classification

With consultation with Hort Innovation, the CIE identified 25 regions for the study (chart A.6), reflecting the concentration of horticulture industry.

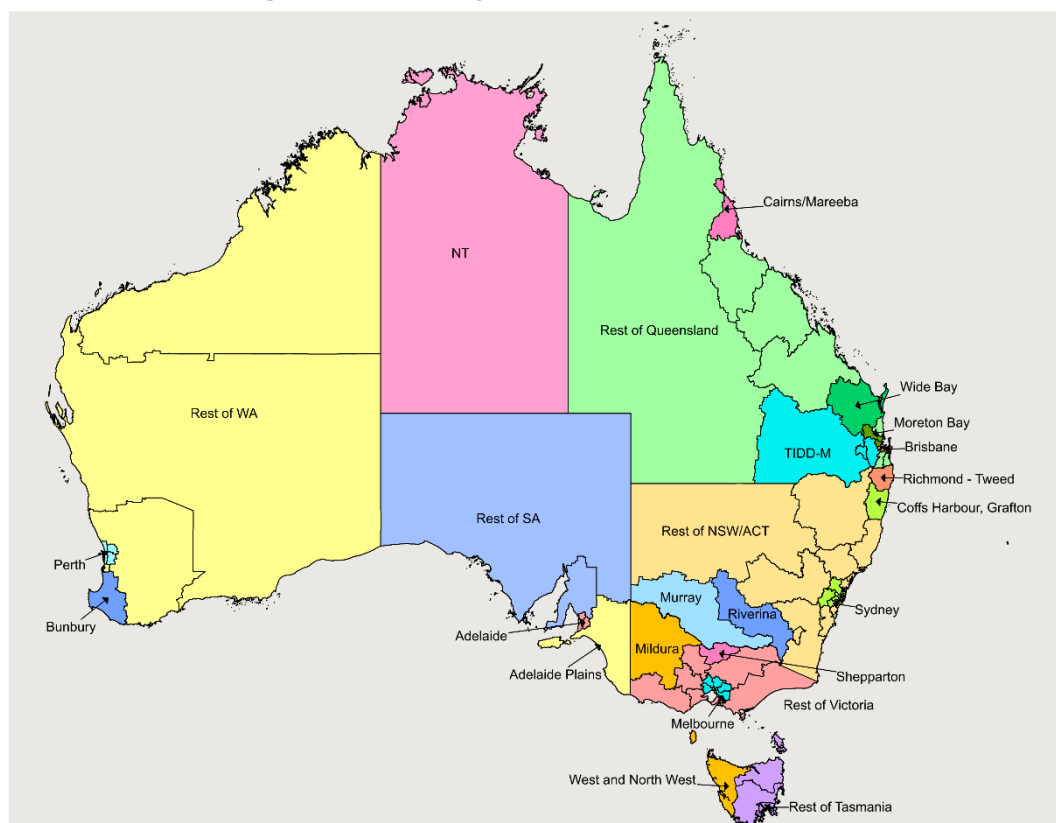
The classification of regions is based on the ABS Statistical Area Level 4 (SA4), such that regional results can sum up to state results and then national results. Table A.7 provides the mapping of these 25 regions to corresponding SA4s.

Four regions are chosen for case studies:

- Coffs Harbour, Grafton (104 Coffs Harbour – Grafton) in NSW;
- Mildura (215 North West) in Victoria;
- Cairns/Mareeba (306 Cairns) in Queensland; and
- Adelaide Plains (407 South Australia – South East).

These regions are corresponding to a single SA4 region and their traditional name and the SA4 name are used interchangeably in this report.

A.6 Horticulture regions for the analysis



Note: TIDD-M: Toowoomba, Ipswich, Darling Downs - Maranoa

Data source: CIE

A.7 Regional concordance

State/Territory	Region	Corresponding SA4s
NSW/ACT	Coffs Harbour, Grafton*	104 (Coffs Harbour – Grafton)
	Richmond - Tweed	112
	Riverina	113
	Murray	109
	Sydney	115-128
	Rest of NSW/ACT	101-103, 105-108, 110-111, 114, 801
Victoria	Mildura*	215 (North West)
	Shepparton	216
	Melbourne	206-213
	Rest of Victoria	201-205, 214, 217
Queensland	Cairns/Mareeba*	306 (Cairns)
	Wide Bay	319
	Moreton Bay	313, 314

State/Territory	Region	Corresponding SA4s
	Brisbane	301-305
	Toowoomba, Ipswich, Darling Downs – Maranoa (TIDD-M)	307, 310, 317
	Rest of Queensland	308, 309, 311, 312, 315, 316, 318
SA	Adelaide Plains*	407 (South Australia – South East)
	Adelaide	401-404
	Rest of SA	405, 406
WA	Bunbury	501
	Perth	503-507
	Rest of WA	502, 509-511
Tasmania	West and North West	604
	Rest of Tasmania	601-603
NT	NT	701, 702

Note: * denotes four case study regions

Source: CIE

B Assumptions for horticulture industry outlook

This appendix presents the derivation of the assumptions for horticulture industry outlooks. The discussion is focused on the Central scenario, with the High and Low scenarios being deviation from the Central one. In most cases the deviation of High and Low scenarios from the Central scenario are determined according to the standard deviation of the historical data.

Export demand factors

Global economic growth

The global economy has been hit by the COVID-19 pandemic since 2020, and the recent war in Ukraine has slowed the recovery. According to the latest *World Economic Outlook* (WEO) by the International Monetary Fund in April 2022, global growth is projected to slow from an estimated 6.1 per cent in 2021 to 3.6 per cent in 2022 and 2023, representing 0.8 and 0.2 percentage points lower for 2022 and 2023 than projected in January 2022.²⁷

The WEO projected that the global economy will grow by a slightly slower pace of 3.26 per cent per annum by 2027. It is further assumed that the growth will gradually revert to its long term rate of 3.3 per cent per annum by 2030 for the Central scenario (the red line in chart B.1).

For the High scenario, the January 2022 projection was used for 2022, that is, 0.8 percentage points higher than the Central scenario assumptions. The 0.8 per cent is about 67 per cent of the standard deviation of historical growth rate. It is therefore to assume that the growth rate will be higher than the Central series by half of the standard deviation (0.59 percentage points) for the rest of the projection period (solid grey line in chart B.1).

For the Low scenario, it is assumed that the growth rate will be 0.8 percentage points lower than the Central scenario for 2022, and 0.59 percentage points lower for the rest of the projection period (dashed grey line in chart B.1)

²⁷ IMF 2022, *World Economic Outlook: War Sets Back the Global Recovery*, April 2022, International Monetary Fund, available at <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>

B.1 Historical and assumed world economic growth

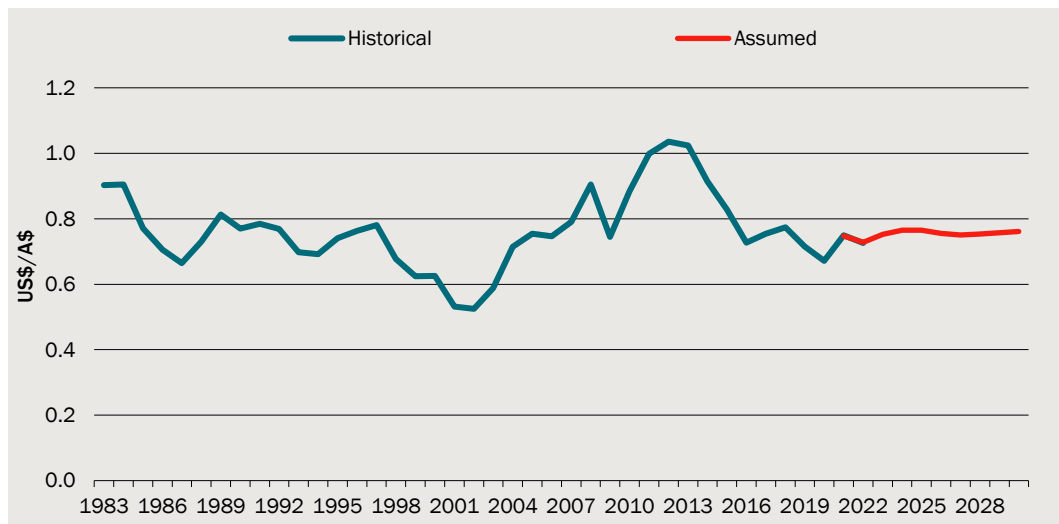


Data source: IMF and CIE

Exchange rate

Export demand is also affected by exchange rate. But it is difficult to project the exchange rate because it is determined by many factors and thus experiences significant volatility, visible in the historical annual average exchange rate of Australian dollar to the US dollar (the teal line) in chart B.2. Since its floating in 1983, the average exchange rate of Australian dollar to the US dollar has been US\$0.763 per A\$, with a low of below \$US0.5 in March 2001 and a high of almost US\$1.1 in July 2011.

B.2 Exchange rate



Data source: historical data between Jan 1983 and Apr 2022 from RBA, 2022 to 2027 from OCE, and the rest are CIE assumptions

In the March 2022 quarter edition of *Resources and Energy Quarterly*, the Office of Chief Economist (OCE) at the Department of Industry, Science, Energy and Resources forecast a depreciation of Australian dollar against the US dollar by 2.6 per cent to

US\$0.7283/A\$ in 2021-22, followed by appreciation to US\$0.765 in 2023-24, before slightly depreciating to US\$0.75/A\$ in 2026-27 (the red line in chart B.2).

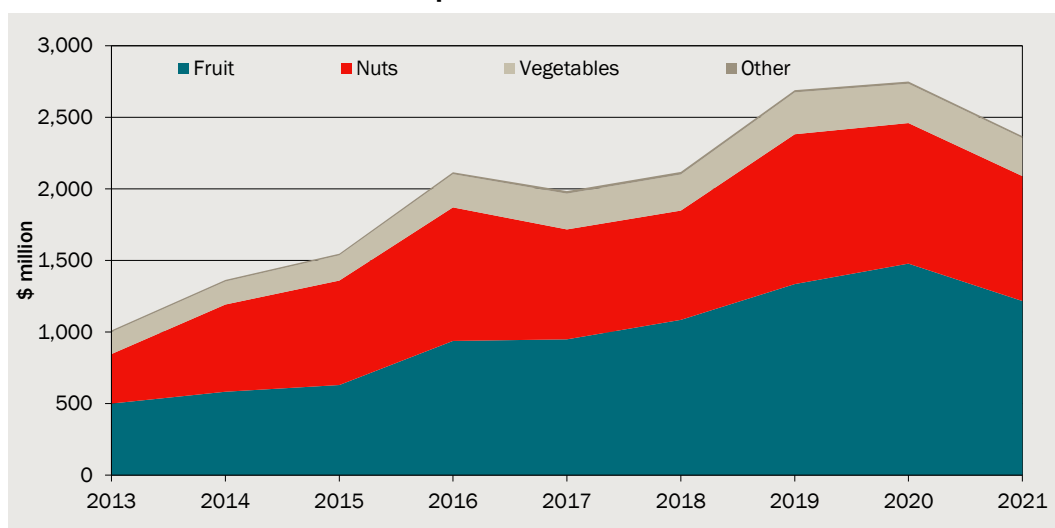
Beyond 2026-27, it is further assumed that the exchange rate will gradually return to its long term average of US\$0.761/A\$ by the end of the projection period.

Because the exchange rate is compounded with export prices to determine the export demand, and the complexity exists in predicting the exchange rate, no other scenarios are assumed for the exchange rate. Its impacts will be incorporated into the development of export price scenarios.

Export market prospects

Despite fluctuations, total value of horticulture exports increased from \$1 billion in 2012-13 to \$2.37 billion in 2020-21 (chart B.3) according to *Australian Horticulture Statistics Handbook*.

B.3 Total value of horticulture exports



Data source: Australian Horticulture Statistics Handbook

It is estimated that the export volume grew by 7.24 per cent per annum and the export price up by 4.11 per cent per annum, leading to an annual growth of 11.65 per cent in total horticulture export value (table B.4).

In its March quarter 2022 outlook,²⁸ ABARES provided export value forecast for broader horticultural sectors as summarised in table B.5. However the impacts of export volume and price were not separately identified.

²⁸ ABARES 2022, *Agricultural commodities: March quarter 2022*, ABARES, Canberra, March 2022, available at <https://www.awe.gov.au/abares/research-topics/agricultural-outlook/data#agricultural-commodities>

B.4 Annual growth rate of horticulture exports between 2012-13 and 2020-21

	Volume	Price	Value
	%	%	%
Fruit	8.25	5.57	14.28
Nuts	6.80	2.88	9.87
Vegetables	4.82	3.41	8.39
Nursery	4.25	0.00	4.25
Total	7.24	4.11	11.65

Source: CIE calculation based on Australian Horticulture Statistics Handbook

B.5 ABARES projection of horticulture exports growth

	2022	2023	2024	2025	2026	2027
	%	%	%	%	%	%
Fruit	-0.28	5.00	4.28	5.60	9.78	14.43
Nuts	5.28	5.00	4.28	5.60	9.78	14.43
Vegetables	18.21	5.00	2.86	0.01	0.01	0.00
Nursery	-1.76	-2.50	2.26	-0.84	-7.18	-5.06
Other ^a	-1.79	-2.50	2.26	-0.84	-7.18	-5.06

^a Other horticulture includes mainly coffee, tea, spices, essential oils, vegetables for seed and other miscellaneous horticultural products.

Note: growth of real export value

Source: ABARES (2022)

In our projection under the Central scenario, the export price changes for individual commodities are devised such that the aggregate export value change follows the ABARES projections as reported in table B.5. Beyond 2027, it is assumed that individual commodity export price will change with the historical average as reported by the *Australian Horticulture Statistics Handbook*.

Overall the trend growth rate of horticulture export prices has been 4.1 per cent per annum with significant variation over time – the standard deviation of the growth rate has been about 10 percentage points. It is therefore to assume that a quarter of the standard deviation of the export price change of individual commodities will be added or extracted from the assumed price growth under the Central scenario to form assumptions for the High or Low scenarios.

Australian macro factors

Australian economic growth

As shown in chart B.6, Australian income measured by the per capita GDP had been in a downward trend since mid 1990s, and hit by the COVID-19 pandemic in 2020 (the teal line in the chart). The jump in 2021 represented a recovery from the fall in the previous year.

In the April 2022 WEO, IMF forecast a moderate growth of 3.3 per cent in 2022, which is lower than the projected growth of 3.6 per cent in its Oct 2021 outlook and the projected growth of 3.5 per cent in the Federal Budget 2022-23.²⁹

The Federal Budget 2022-23 considered scenarios reflecting the COVID-19 related uncertainty about the economic outlook:³⁰

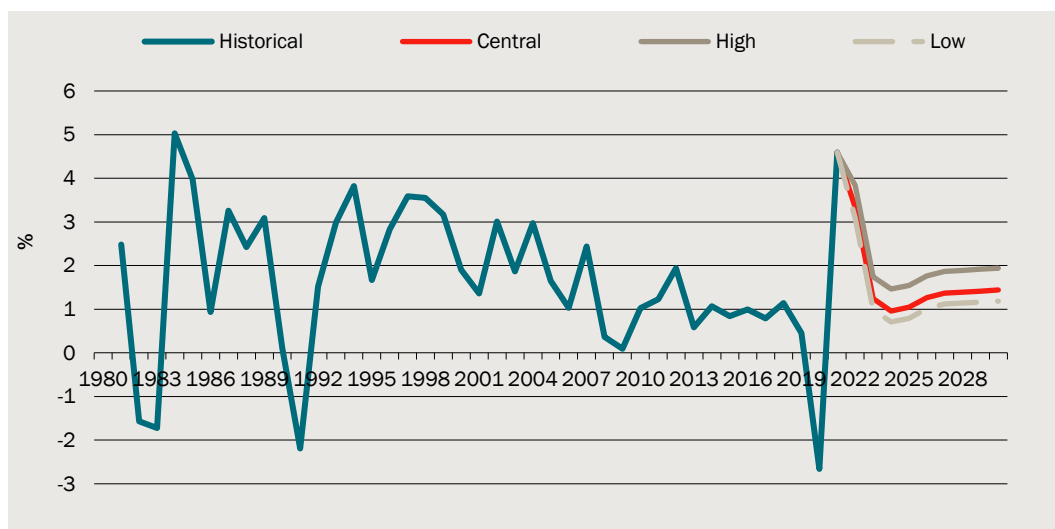
- A new COVID-19 variant of concern poses a more challenging health environment, resulting a half percentage point contraction from the forecast; and
- An improved health situation delivers a boost to confidence, lifting the growth by a quarter of percentage point above the forecast.

The 0.5 percentage point is equivalent to half of the standard deviation of historical income growth.

For the Central scenario, we adopted the IMF projected growth rate up to 2027 and further assumed a gradual rise to the long-term average growth rate after that (the solid red line in chart B.6).

For the High and Low scenario, we used the above discussed deviations from the Federal Budget, that is, a 0.5 per centage point above and a 0.25 percentage point below the Central growth rate assumptions (solid grey and dashed grey lines in chart B.6).

B.6 Historical and projected Australian income growth



Data source: IMF and CIE

²⁹ Government of Australia 2022, *Budget Paper No.1: Budget Strategy and Outlook*, Treasury, March 2022, Table 2.1, p.37.

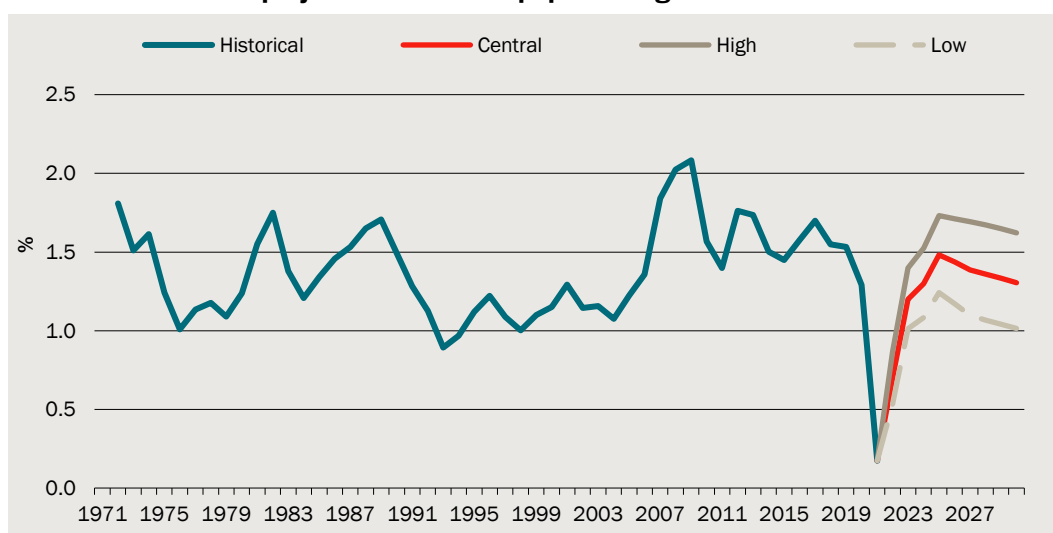
³⁰ *ibid*, Box 2.4 and Chart 2.8, p.48-49

Australian population growth

The growth rate of Australian population fluctuated between 1 and 2 per cent per annum with an average of 1.37 per cent in the past 50 years (chart B.7).³¹ The growth rate plunged to a low of 0.17 per cent in 2021 due to the nearly stopped immigration amid the COVID-19 pandemic.

The Federal Budget 2022-23 projected a modest growth of 0.7 per cent in 2022, followed by 1.2 per cent in 2023 and 1.3 per cent in 2024,³² which is approaching to the ABS medium series projection of 1.48 per cent in 2025, gradually down to 1.31 per cent in 2030³³ (red line in chart B.7). This forms the Central case assumption for the population growth.

B.7 Historical and projected Australian population growth



Data source: ABS, Treasury and CIE

For High and Low scenarios, we used the same deviation of ABS' high and low population projection series from the medium series to developed the population growth assumptions (grey lines in chart B.7).

Productivity improvement

Productivity in horticulture farming sector

Farming productivity in Australia has been affected significantly by the climate conditions (teal line in chart B.8). By removing the climate impact, it is estimated that the

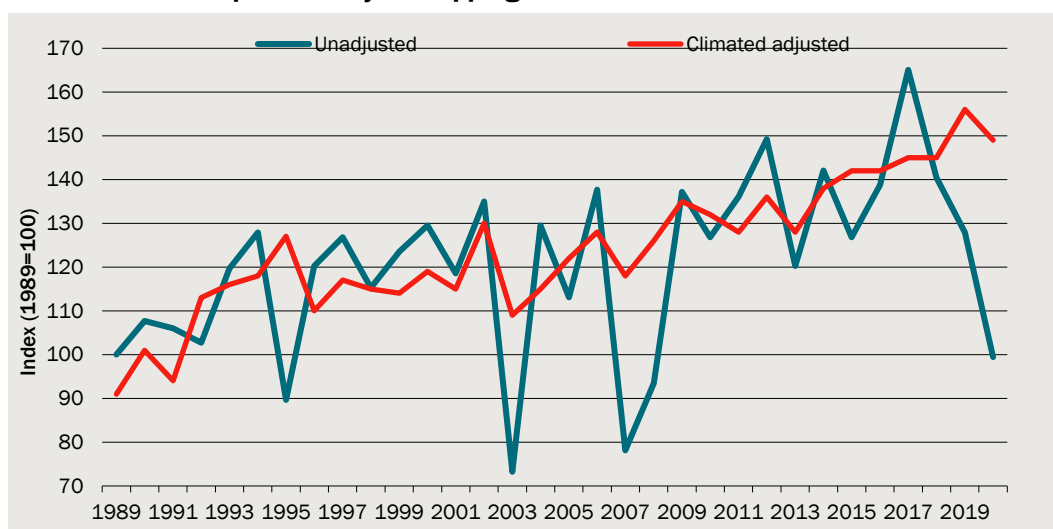
³¹ ABS 2022, *National, state and territory population*, Cat.No.3101.0, Australian Bureau of Statistics.

³² Government of Australia 2022, *Budget 2022-23*, available at <https://budget.gov.au/index.htm>

³³ ABS 2017, *Population Projections, Australia*, Cat.No.3222.0, Australian Bureau of Statistics.

total factor productivity (TFP) in cropping has been increased by 1.2 per cent per annum in the last three decades (red line in chart B.8).³⁴

B.8 Total factor productivity in cropping



Data source: ABARES (2021)

It is therefore to assume that the productivity in the horticultural growing sector will increase by this long term rate (1.2 per cent per annum) over the projection period under the Central scenario.

For the High scenario, we used an annual growth rate of 1.6 per cent which is equivalent to the growth rate of cropping industry productivity over a period of four decades.

For the Low scenario, an annual growth rate of 0.8 per cent is assumed, equivalent to the growth rate of the agriculture industry estimated by the ABS.³⁵

Productivity in horticulture processing sector

According to ABS,³⁶ manufacturing productivity has been falling in recent years – by 0.23 per cent per annum since 2003-04 (chart B.9).

As shown in chart B.9, manufacturing productivity had been growing before 2003-04, at a rate of 1.43 per cent per annum. As a result, over the period from 1989-90 to 2020-2021, the average growth rate has been 0.46 per cent per annum.

While the productivity improvement in the whole manufacturing industry is modest or even falling, some sectors may still have persistent productivity improvement because the industry is big and diversified. With continued growth in agriculture productivity, it is

³⁴ ABARES 2021, *Australian Agricultural Productivity, 2019-20 dashboard*, 28 June 2021, available at <https://www.awe.gov.au/abares/research-topics/productivity/agricultural-productivity-estimates>

³⁵ ABS 2021, *Estimates of Industry Multifactor Productivity, Australia*, Cat.No.5260.0.55.002, December 2021

³⁶ *ibid*

reasonable to assume that agriculture related manufacturing would have continued productivity improvement.

B.9 Multifactor productivity in manufacturing



Data source: ABS (2021)

It is therefore to assume that the productivity in the horticulture processing sector will increase by 0.5 per cent per annum over the projection period under the Central scenario.

The High and Low scenarios will see the productivity in the processing sector grow by 0.75 per cent and 0.25 per cent per annum, respectively. These assumed growth rates are within the historical variation as discussed above.

Labour market conditions

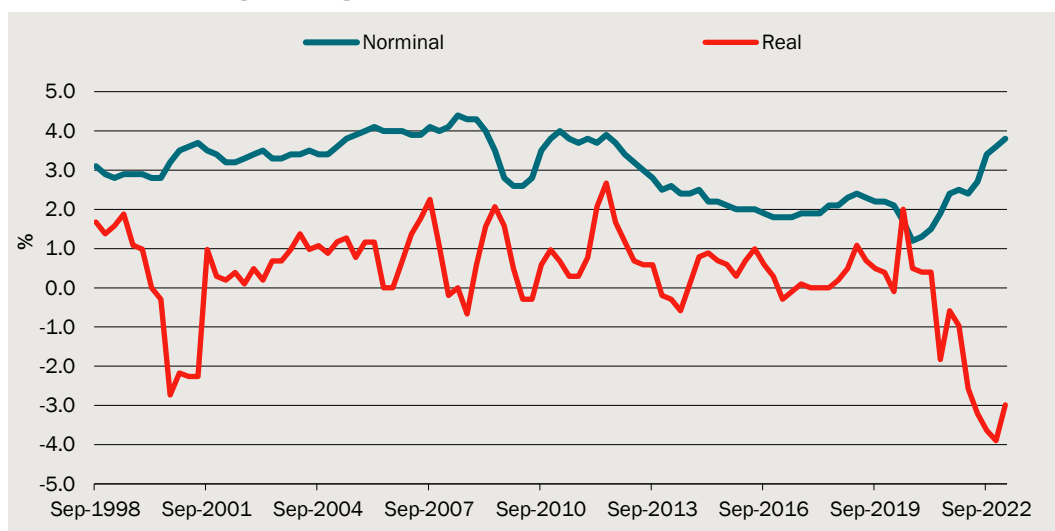
Labour market conditions is particularly important for horticulture because it is a labour intensive industry. Stakeholders have emphasised this issue consistently through the consultations. One of the objectives of this study is to project employment growth in the horticulture industry. This requires a labour market setting which endogenises employment and sets the real wage rate exogenously.

Chart B.10 shows the nominal and real wage growth in Australia from late 1990s to current. The average growth for nominal wage is about 3 per cent, while that for real wage is 0.5 per cent. It can be seen from the chart that the real wage growth series present more significant fluctuations than the nominal wage growth.

The mechanism of determining the real wage rate is rather complex. Although economic theory points out that long term real wage rate growth is determined by the labour productivity growth in a free, competitive economy, the empirical evidence is mixed. For example, Feldstein (2008) noted that productivity and the total real compensation per hour in the US nonfarm business sector increased at approximately the same rate, more specifically 1.9 per cent per annum and 1.7 per cent per annum, respectively, between

1970 and 2006.³⁷ By contrast, Sharpe, Arsenault and Harrison (2008) observed that the median real earnings of Canadian workers stagnated, while labour productivity rose 37 per cent between 1980 and 2005.³⁸ But this might be due to a correction process to the faster growth in real wage between 1961 and 1977. The total growth in real wage rate and productivity in Canada between 1961 and 2007 are comparable – both grew by about 110 per cent.

B.10 Annual change in wage price



Note: Percentage change from the corresponding quarter in the previous year

Data source: ABS, Cat.No.6345.0 and 6401.0

The recent Australian data point to a similar situation to that in Canada as observed between 1980 and 2005. As shown in chart B.11, from 1998 to 2021, labour productivity had increased by 46.6 per cent, but real wage increased by only 12.1 per cent.

This lagging of real wage rate behind labour productivity growth may suggest that there has been an oversupply of labour force, which is at odds with other data. As shown in chart B.12, unemployment rate has been trending down while participation rate up despite fluctuations over time especially in the past two years due to COVID-19 pandemic, pointing to a tight labour market.

It is therefore reasonable to assume that labour productivity is a weak determinant of the real wage rate in the short to medium term, and nominal wage change is a better indicator for the labour market conditions in the short term because the wage rate and the inflation may move at different paces due to wage rigidity.

³⁷ Feldstein, M., 2008, *Did Wages Reflect Growth in Productivity?*, paper prepared for the annual meeting of the American Economic Association, 5 January.

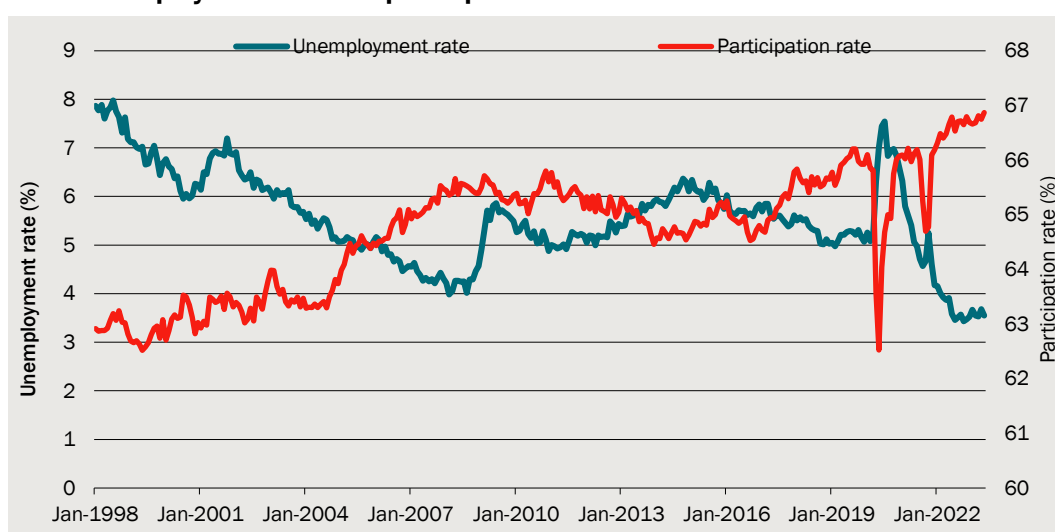
³⁸ Sharpe, A., J.-F. Arsenault and P. Harrison, 2008, *The Relationship between Labour Productivity and Real Wage Growth in Canada and OECD Countries*, CSLS Research Report No. 2008-8, Centre for the Study of Living Standards, Ottawa, Canada.

B.11 Labour productivity and real wage growth in Australia



Data source: ABS Cat.No.5260.0.55.002 and 6345.0

B.12 Unemployment rate and participation rate in Australia



Data source: ABS Cat.No.6202.0

Some developments that affect the labour supply to the horticulture industry are worth noting:

- Lifting restrictions on international travellers is expected to improve labour availability in the short term;
- Changes in the visa arrangements, such as temporarily removing the limit on Student visa holders' working hours and temporarily relaxing the 6-month work limitation for Working Holiday Maker visa holders, are also improve seasonal labour availability;
- Inclusion of a minimum hour wage guarantee in the Horticulture Award and a requirement to record hours worked by pieceworkers from 28 April 2022 may have mixed effects on the horticulture labour market. It will increase the labour cost for casual workers at the margin, while inducing more interests in working in the industry.

In sum, for the Central scenario, it is assumed that labour cost will grow at 2.4 per cent per annum for 2021-22 and 2022-23. After that, the labour cost growth rate will be gradually moving to the 20-year average of 0.5 per cent by 2029-30, reflecting the easing of labour market conditions with the world gradually coming out of the pandemic.

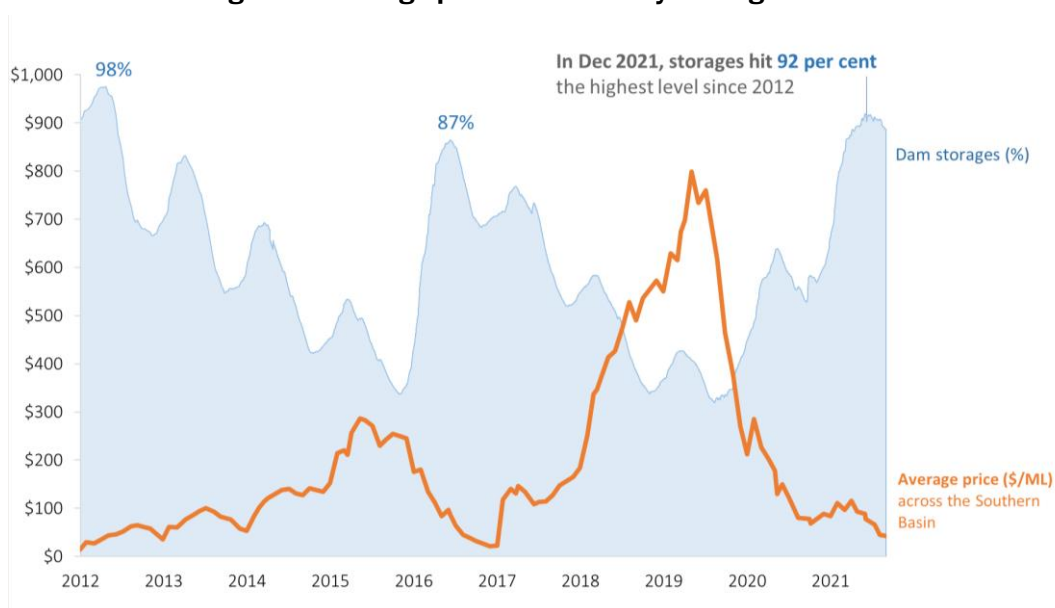
For the High scenario, lower wage increases are assumed because lower wage growth reduces the labour input costs to the horticulture industry and thus boosts the industry. Specifically, it is assumed that labour cost will grow at 2 per cent per annum for 2021-22 and 2022-23, and then gradually move to 0.4 per cent per annum by the end of the projection period.

For the Low scenario, it is assumed the labour cost will grow at 3 per cent per annum for 2021-22 and 2022-23, and then gradually move to 0.6 per cent per annum by 2030.

Weather conditions

Australian agriculture has had favourable weather conditions recently with high level rainfalls due to the La Nina climate pattern which is forecast to have a 59 per cent chance of continuing across winter and up to a 50 per cent chance of persisting next spring.³⁹

B.13 Water storages and average price in the Murray-Darling Basin



Data source: Downham et al (2022), Figure 1

As an indication of a generally favourable weather condition (despite flooding in growing regions that has adverse impacts on production), water prices fell significantly from the

³⁹ McGuire, A. 2022, 'Wet winter ahead as La Nina stays', *The Sydney Morning Herald*, 25 May 2022.

historical high in 2019-20 (chart B.13), and are forecast to remain low for a third consecutive year⁴⁰.

The average water price will increase slightly from \$77/ML in 2021-22 to \$80/ML in 2022-23 under ABARES average scenario, or decrease to \$57/ML under the wet scenario.⁴¹

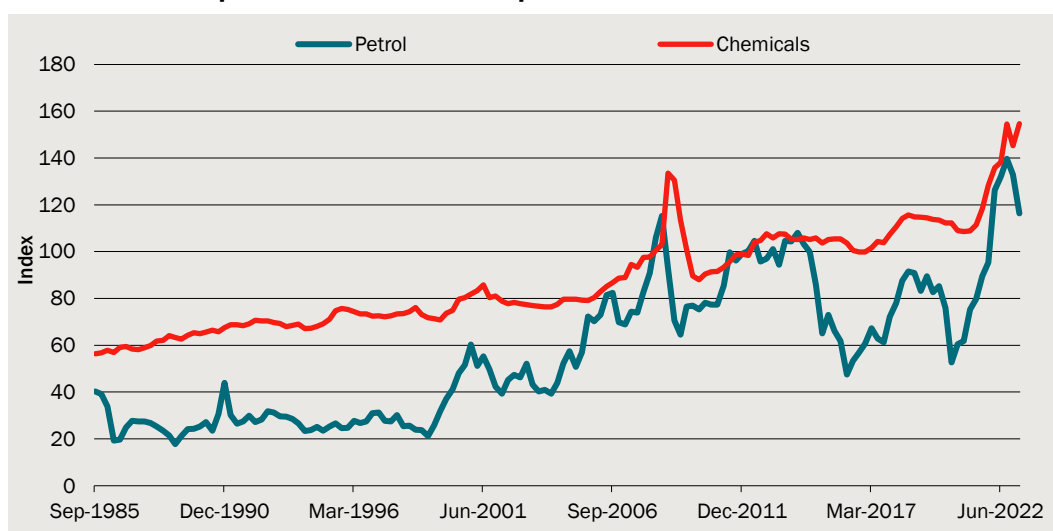
Given La Nina is to continue, it is assumed under the Central scenario that a wet condition will continue for 2022-23 with water price falling by 26 per cent. After that, the average condition will prevail, with water price increasing by 3.9 per cent per annum over the remainder of the projection period.

For High scenario, it is assumed that the water price will not change after 2022-23, while for the Low scenario, the water price will increase from \$57/ML in 2022-23, to \$80/ML in 2023-24 and then to \$130/ML by the end of the projection period.

Other input costs

Fuel and chemicals are important inputs to horticulture production. As shown in chart B.14, both inputs present significant fluctuations in price change, especially for petroleum products. The recent fluctuations have been the result of the COVID-19 pandemic and the Russian-Ukraine war.

B.14 Petroleum products and chemicals price index



Data source: ABS Cat.No.6427.0, Table 14

⁴⁰ Downham, R., J. Walsh, T. Westwood and M. Gupta 2022, *Water Market Outlook*, April 2022, ABARES, <https://www.awe.gov.au/abares/research-topics/water/water-market-outlook#:~:text=The%20amount%20of%20water%20available,per%20ML%20across%20the%20sMDB.>

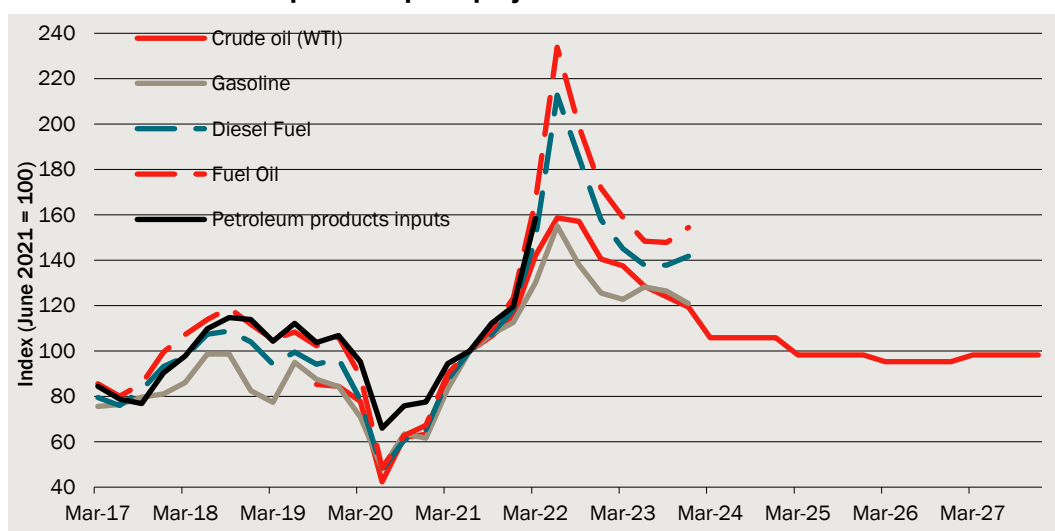
⁴¹ *ibid.*, Table 1, p.8

Fuels

Over the last three decades, the price of petroleum products as inputs increased by 1.1 per cent per annum, while the price of chemicals increased by 0.5 per cent per annum.

In the March 2022 edition of *Resources and Energy Quarterly*, the Office of Chief Economist (OCE) at the Department of Industry, Science, Energy and Resources forecast that the crude oil price would peak in June quarter of 2022, with the price being 58.6 per cent higher than the level in June 2021 (solid red line in chart B.15). It will fall to a level that is less 6 per cent higher than the June 2021 price by March 2024, and then gradually down to 5 per cent lower than the June 2021 price by March 2026, before slightly increasing to a level about 2 per cent lower than the June 2021 price in 2027.

B.15 Crude oil and oil products price projections



Note: LNG and crude oil price projections from *Resources and Energy Quarterly* by OCE; gasoline, diesel fuel and fuel oil prices from STEO by EIA; and petroleum products inputs price from ABS

Data source: ABS, OCE and EIA

The *Short-Term Energy Outlook (STEO)*⁴² by the US Energy Information Administration (EIA) also forecast a peak of fuel prices (refiner prices for resale) in June quarter 2022, but with different magnitude. It is forecast that the price for fuel oil in June 2022 will jump to a level more than 2.3 times of the price one year earlier, and then fall to a level about 1.5 times of the June 2021 price in late 2023, representing a fall of more than 30 per cent (the dashed red line in chart B.15).

The spike of diesel fuel is slightly less than that of fuel oil, with the peak price being about 2.1 times of the June 2021 price (the dashed teal line in chart B.15). The increase in gasoline price (the grey line in chart B.15) is similar to OCE's projection for crude oil.

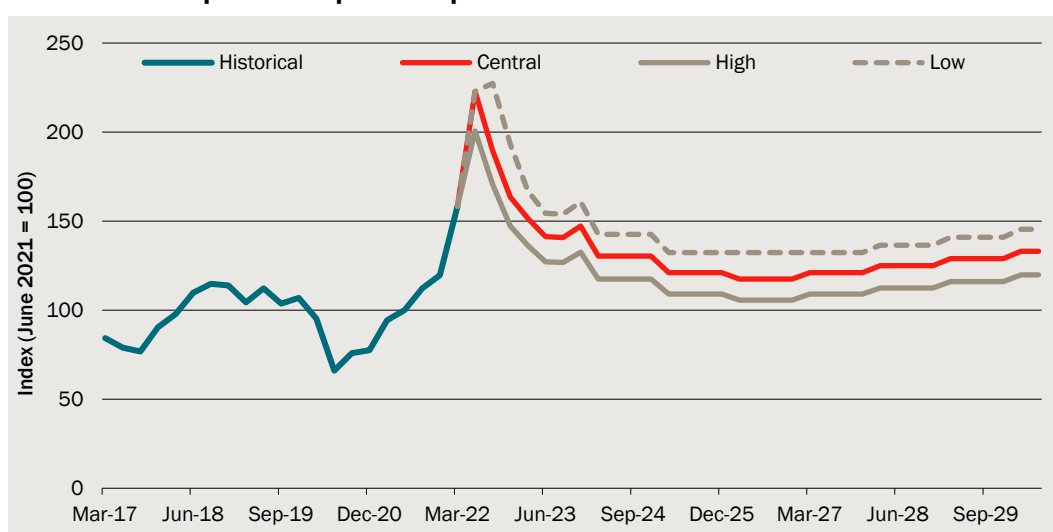
Historically, the movement of EIA fuel oil price matches the movement of price index of petroleum products as inputs into production reported by ABS (the solid black line in chart B.15). This is because both of them are petroleum products rather than crude oil. It is therefore to adopt the EIA projection up to December 2023 for the modelling under the

⁴² EIA 2022, *Short-Term Energy Outlook*, <https://www.eia.gov/outlooks/steo/>

Central scenario. After 2023, it is further assumed that the input price will follow the trend of crude oil price projections by OCE with a higher starting price (the red line in chart B.16).

For the High scenario, it is assumed a modest increase in the fuel prices as suggested by the OCE crude oil price projections with a peak in June 2022. It will then fall by the same pace in the Central scenario with the price being about 9.3 per cent lower than the Central case price by 2030 (the solid grey line in chart B.16). The price in 2030 under the Low scenario will be slightly higher than the price level before the COVID-19 pandemic.

B.16 Assumed petroleum products price



Data source: ABS data and CIE assumption

For the Low scenario, it is assumed that the price will continue to rise to peak by the end of 2022, and then fall by the similar pace to the assumed change in the Central scenario, with the price being about 10 per cent higher than the Central case by 2030 (the dashed grey line in chart B.16).

It should be noted again that the High and Low scenarios are about the horticulture industry outlooks rather than the input prices. Therefore the High and Low scenarios are assuming low and high input prices respectively.

Chemicals

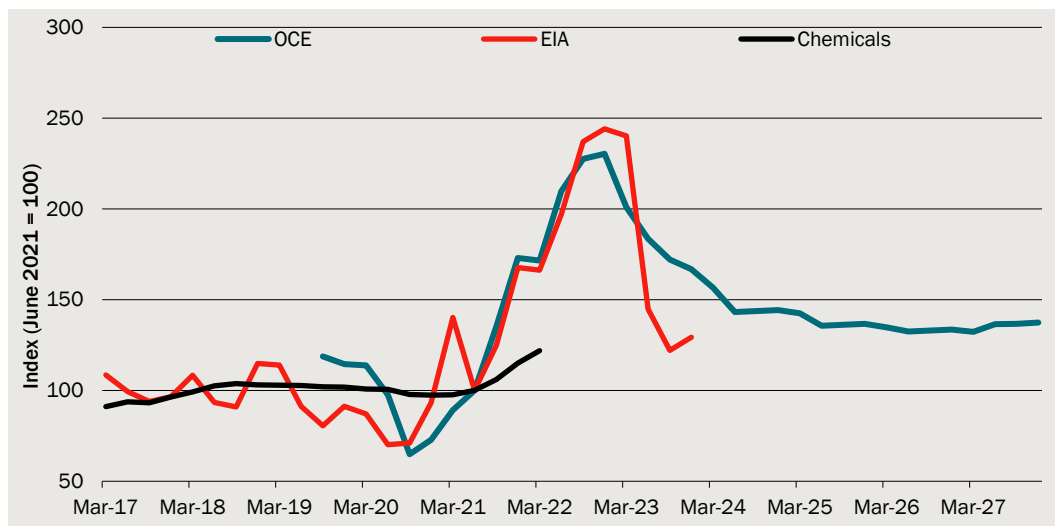
Chemicals used in agriculture production are mainly fertiliser and pesticides. Fertiliser prices are affected by natural gas prices. For example, urea prices roughly doubled between July and November 2021 as natural gas is a key input in its manufacturing.⁴³

The OCE projected a peak in natural gas prices in December quarter 2022 with a level being 2.3 times of the June 2021 price (the red line in chart B.17). The EIA also forecast a peak in December quarter 2022, with a slightly higher growth – being 2.4 times of the June 2021 price, and a sharper fall in 2024 (the teal line in chart B.17).

⁴³ ABARES 2022, *Agricultural forecasts and outlook*, March quarter 2022, p.13

The historical chemicals price series compiled by ABS (the black line in chart B.17) show much less volatility than the historical natural gas price changes. For example, chemicals price was 22 per cent higher in March 2022 than in June 2021, while natural gas price was 70 per cent higher. This is because the ABS series are prices of chemicals used in manufacturing which has a broader coverage of products.

B.17 Projected natural gas price indexes versus historical chemicals price index



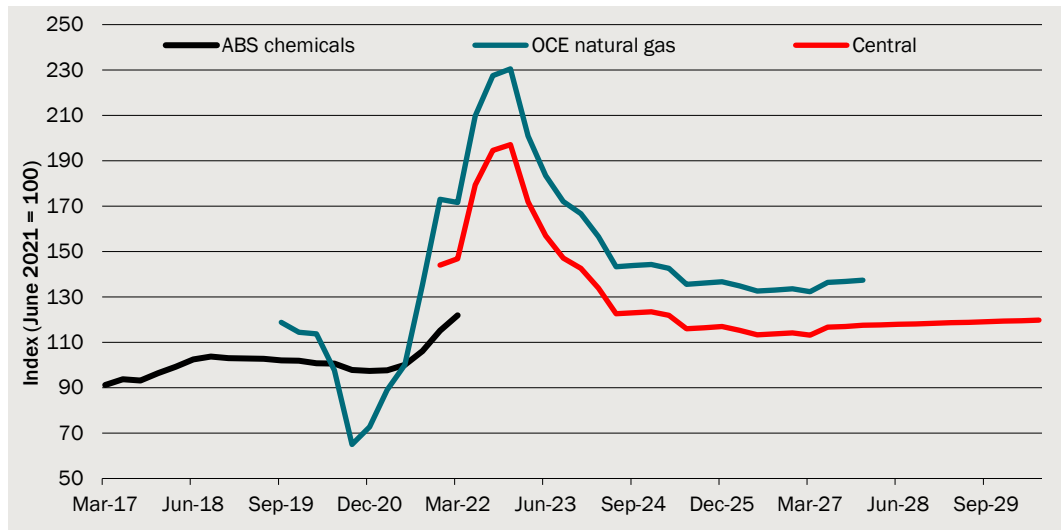
Note: LNG fob price by OCE, natural gas price in industrial sector by EIA, chemicals price index by ABS

Data source: ABS, OCE and EIA

As mentioned above, chemicals used in horticulture have a higher proportion of fertilisers which are in turn affected by the natural gas prices. It is therefore to suggest that the price change of chemicals used in horticulture would be between the natural gas price change and the chemicals used in manufacturing for the Central scenario. More specifically, it is assumed that the future chemicals price would follow the OCE projections adjusted by half of the difference between the ABS and OCE series in March 2022 (the red line in charts B.18 and B.19).

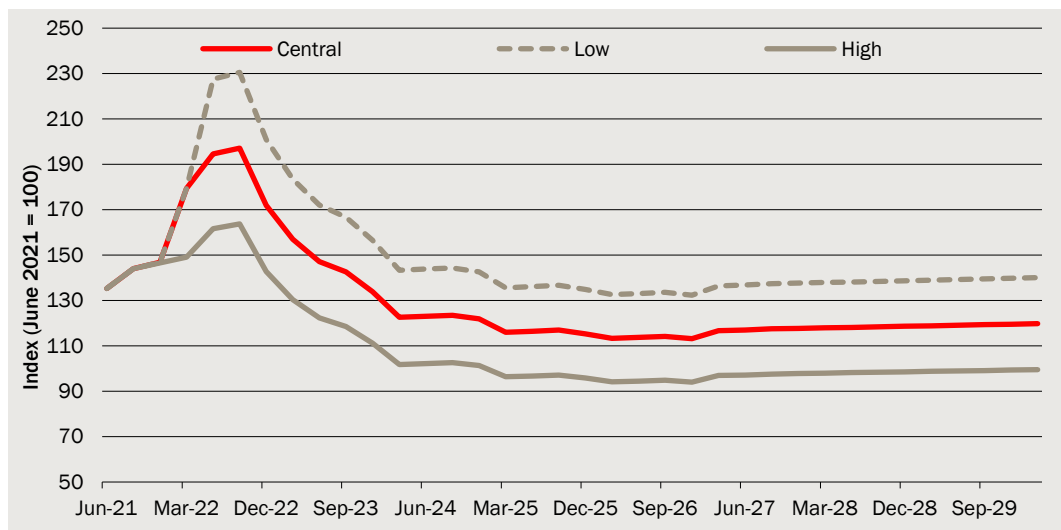
ABS chemicals price index and the OCE natural gas index which present a 17 per cent deviation from the Central case assumptions at the base are used to develop the assumptions for the High scenario (solid grey line in chart B.19) and the Low scenario (dashed grey line in chart B.19), respectively.

B.18 Historical and assumed price change for natural gas and chemical products



Data source: ABS, OCE and CIE assumption

B.19 Scenario assumptions for chemicals price change



Data source: ABS, OCE and CIE assumption