
Agribusiness & Economics Research Unit
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# State of the Canterbury Food and Fibre Sector, 2020

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Client Report for

Canterbury Food and Fibre Innovations

September 2020

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**Suggested citation for this report**

Saunders, C., M. Guenther, T. Driver and P. Dalziel (2020). *State of the Canterbury Food and Fibre Sector, 2020*. AERU Client Report prepared for Canterbury Food and Fibre Innovations. Lincoln University: Agribusiness and Economics Research Unit.

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# Acknowledgements

The authors gratefully acknowledge funding from the Canterbury Mayoral Forum's *Canterbury Food and Fibre Innovations* programme (facilitated by David Rendall) and from the Lincoln University Centre of Excellence *Food for Future Consumers* (chaired by Associate Professor Roland Harrison). The authors are also grateful to David Rendall for valuable discussions during the preparation of this report. We thank those who provided very helpful comments on an early draft, including Simon Anderson, David Bromell, Tim Davie, Elizabeth Hopkins, Maxine Bryant, Rebecca Warr, Michael Shone and Alexandra Sturthridge. We thank the five institutions that provided employment data on researchers in the Canterbury region, reproduced in Figure 6.8.

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# Chapter 1

# Introduction

## 1.1 Background to this Report

An important feature of the Canterbury economy is the world-class quality of its food and fibre products, a large amount of which is exported. Canterbury has enjoyed a high reputation for this quality for more than a century. As early as 1895, for example, newspapers were commenting that 'Canterbury' had become the standard term for the best class of meat exported from New Zealand.[1]

The food and fibre sector extends well beyond the land-based producers. A report commissioned from the AERU in 2005 reported that nationally, agri-food primary industries account for about 6 per cent of gross domestic product. Processing industries account for a further 6 per cent, and other industries providing inputs to the producers and processors added another 7 per cent. Thus, nationally the food and fibre sector is about 19 per cent of gross domestic product.[2]

The interconnections between producers and other parts of the economy mean that land-based enterprises make important contributions to urban economies. In 2012, the AERU surveyed farms and rural businesses in the Selwyn and Waimakariri districts of Canterbury to estimate the percentage of expenditure on inputs to farm businesses that flowed into Christchurch City. Annually, $306 million of farm (including their households) expenditure and $511 million of secondary farm expenditure via rural businesses is directly spent in Christchurch – a total of $817 million. The flow-on effects of this expenditure, including the direct, indirect and induced effects of farms, and their secondary flows via purchases from rural businesses, were valued at $2.2 billion. This accounted for 10 per cent of Christchurch's total gross output and was associated with 12,564 full-time employees in the city.[3]

As part of the Canterbury Regional Economic Development Strategy, the Canterbury Mayoral Forum has initiated the *Canterbury Food and Fibre Innovations* programme. The programme convened a workshop with key institutions working across the Canterbury food and fibre sector, hosted by Blinc Innovation at Lincoln University on 29 April 2019. The workshop recognised that it is currently difficult to gain common line of sight across different data sets and existing repositories related to the sector.

Consequently, the workshop recommended work towards creating an open regional data and analytics platform that should be openly available to all stakeholders including farmers, agribusinesses and start-up businesses, as well as the Councils and other rural and regional groups. Painting a unified story of sustainability for the Canterbury region (economic, environmental and social) would be a powerful story that would help businesses and constituent stakeholders in Canterbury and New Zealand, including those involved in exports.

[1] Saunders *et al*. (2016a, p. 45).

[2] Saunders *et al*. (2016a, p. 16).

[3] Saunders *et al*. (2016a, p. 25).

As part of that work, the Canterbury Mayoral Forum commissioned the Agribusiness and Economics Research Unit at Lincoln University to prepare this initial report on the state of the Food and Fibre sector in Canterbury. The Food for Future Consumers Centre of Excellence also contributed to the funding of the report as part of its mission to improve links between provenance (such as place of origin, authenticity, land, agro-ecosystems) and food qualities (such as production values, composition and preference). [4]

This authors were asked to describe the full sector (production, processing and associated services) across the full range of food and fibre industries, with a focus on exported food and fibre products. The report also presents statistical indicators associated with the sector.

## 1.2 Structure of the Report

After this introductory chapter, the report consists of four further chapters. Chapter 2 presents data describing the Food and Fibre sector in Canterbury, with separate sections describing Canterbury producers and Canterbury processors. A third section presents a stocktake of exported food and fibre products through Lyttelton Port, Timaru Port and Christchurch International Airport.

Chapter 3 develops that analysis with further statistical indicators for the sector. It moves beyond producers and processors to consider also the service industries to the food and fibre sector. This chapter presents data on contributions to gross domestic product, employment, income and land use patterns.

Chapter 4 addresses the question of how to create additional value from the Canterbury Food and Fibre sector, recognising that significant change is already taking place, led by industry initiatives and supported by public sector programmes. The chapter explains the movement from volume to value by communicating a product's *credence attributes*. These are product qualities that cannot be seen immediately or experienced during consumption, but rely on consumer trust, supplier communication or independent verification. Examples include food safety, environmental stewardship, animal welfare, social responsibility and cultural authenticity.

Chapter 5 broadens the analysis again by applying a wellbeing economics lens to the state of the sector. This recognises that the New Zealand government presented the world's first Wellbeing Budget to Parliament in 2019. This report uses an AERU version of the Treasury's Living Standards Framework to present material on how the Canterbury Food and Fibre sector contributes to wellbeing.

Chapter 6 is a concluding chapter summarising the key messages from the analysis. It finishes with a set of eight proposed statistical indicators for monitoring the long-term prosperity of Canterbury's Food and Fibre sector.

[4] See https://www.lincoln.ac.nz/research/research/lucoe/ffc/?sti=1. The authors are grateful to the chairperson of the centre, Associate Professor Roland Harrison, for his support for this project.

# Chapter 2

# Canterbury's Food and Fibre Sector

## 2.1 Introduction

This section presents data describing the Food and Fibre Sector in Canterbury, drawn mostly from the Australian and New Zealand Standard Industrial Classification (ANZSIC). The sector is defined here as the sum of primary producers and processors in the region. Section 2.2 will present data on the producers and Section 2.3 will present data on the processors. Section 2.3 then presents data on exported food and fibre products through the three Canterbury ports (Lyttelton, Timaru and Christchurch International Airport).

## 2.2 Primary Producers

The primary production sector in the National Accounts includes agriculture, forestry and fishing, plus mining. Except when it is not possible to separate the subcategories, mining is excluded in this report from the definition of the Food and Fibre primary production sector. This leaves the following seven industries as making up the primary producers:

1. Horticulture and Fruit Growing;
2. Sheep, Beef Cattle and Grain Farming;
3. Dairy Cattle Farming;
4. Poultry, Deer & Other Livestock Farming;
5. Forestry and Logging;
6. Fishing and Aquaculture; and
7. Agriculture Support Services and Hunting.

There are a large number of businesses in Canterbury's Food and Fibre production sector. Table 2.1 illustrates the number of businesses in the relevant industries in Canterbury for the period 2010 to 2019. In 2019, there were 9,531 businesses in agriculture, forestry and fishing. Within that group, the largest number of businesses was recorded for the sheep and beef industry (3,984 businesses), followed by dairy (1,764 businesses), then agriculture, forestry and fishing support services (1,083 businesses). In 2019, thirteen per cent of all Canterbury businesses were related to agriculture, forestry and fishing.

Table 2.1 reflects the large number of conversions to dairy farming in the last decade. Between 2010 and 2019 the number of businesses in the agriculture, forestry and fishing sector dropped by 14 per cent, with the largest decrease in sheep, beef cattle and grain businesses (a fall of 21 per cent). In contrast, the number of businesses in dairy cattle farming grew by 28 per cent. The number of poultry farming businesses also grew, by 20 per cent.

**Table 2.1 Number of Businesses in the Food and Fibre Production Industry, Canterbury, 2010–2019**

| **Industry (ANZIC06)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|
| Nursery and Floriculture Production | 300 | 288 | 225 | 216 | 213 | 156 | 150 | 153 | 159 | 156 |
| Mushroom and Vegetable Growing | 264 | 267 | 249 | 240 | 246 | 201 | 195 | 195 | 180 | 183 |
| Fruit and Tree Nut Growing | 516 | 498 | 447 | 477 | 468 | 399 | 390 | 378 | 333 | 336 |
| Sheep, Beef Cattle and Grain Farming | 5,058 | 4,878 | 4,902 | 4,623 | 4,560 | 4,713 | 4,428 | 4,236 | 4,062 | 3,984 |
| Other Crop Growing | 561 | 657 | 651 | 708 | 699 | 699 | 819 | 858 | 690 | 513 |
| Dairy Cattle Farming | 1,374 | 1,470 | 1,563 | 1,566 | 1,629 | 1,758 | 1,761 | 1,749 | 1,677 | 1,764 |
| Poultry Farming | 75 | 75 | 81 | 81 | 78 | 87 | 87 | 84 | 84 | 90 |
| Deer Farming | 444 | 393 | 348 | 318 | 297 | 270 | 270 | 267 | 228 | 207 |
| Other Livestock Farming | 942 | 909 | 867 | 786 | 750 | 801 | 756 | 729 | 648 | 600 |
| **Agriculture Total** | **9,528** | **9435** | **9,339** | **9,021** | **8,946** | **9,081** | **8,853** | **8,643** | **8,064** | **7,830** |
| Aquaculture | 27 | 27 | 27 | 24 | 21 | 24 | 24 | 27 | 24 | 24 |
| Forestry and Logging | 519 | 501 | 492 | 462 | 450 | 468 | 477 | 468 | 435 | 432 |
| Fishing, Hunting and Trapping | 153 | 165 | 162 | 171 | 180 | 180 | 180 | 180 | 174 | 162 |
| Agriculture, Forestry and Fishing Support Services | 903 | 897 | 897 | 933 | 999 | 1044 | 1035 | 1044 | 1137 | 1083 |
| **Total Agriculture, Forestry and Fishing** | **11,127** | **11,025** | **10,917** | **10,608** | **10,599** | **10,797** | **10,566** | **10,365** | **9,837** | **9,531** |
| **Total All Industry** | **65,163** | **64,749** | **64,290** | **65,535** | **68,373** | **70,485** | **71,376** | **72,219** | **72,144** | **72,714** |

*Source*: Statistics New Zealand (2020a).

**Table 2.2 Employee Count in the Food and Fibre Production Industry, Canterbury, 2010–2019**

| **Industry (ANZIC06)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|
| Nursery and Floriculture Production | 620 | 580 | 670 | 550 | 610 | 580 | 620 | 640 | 710 | 690 |
| Mushroom and Vegetable Growing | 1,100 | 1,050 | 1,150 | 1,150 | 1,150 | 1,200 | 1,200 | 1,250 | 1,300 | 1,350 |
| Fruit and Tree Nut Growing | 610 | 590 | 560 | 650 | 600 | 620 | 620 | 590 | 430 | 390 |
| Sheep, Beef Cattle and Grain Farming | 3,400 | 3,300 | 3,350 | 3,500 | 3,550 | 3,450 | 3,500 | 3,300 | 3,250 | 3,200 |
| Other Crop Growing | 150 | 170 | 150 | 140 | 170 | 200 | 190 | 250 | 230 | 270 |
| Dairy Cattle Farming | 3,900 | 4,200 | 4,550 | 4,700 | 5,100 | 5,200 | 5,000 | 5,100 | 5,200 | 5,300 |
| Poultry Farming | 200 | 180 | 130 | 190 | 180 | 190 | 220 | 220 | 220 | 220 |
| Deer Farming | 290 | 280 | 240 | 210 | 200 | 150 | 140 | 130 | 180 | 180 |
| Other Livestock Farming | 510 | 470 | 470 | 460 | 450 | 340 | 390 | 410 | 600 | 550 |
| **Total Agriculture** | **10,800** | **10,800** | **11,300** | **11,600** | **12,000** | **11,900** | **11,900** | **11,900** | **12,100** | **12,100** |
| Aquaculture | 80 | 110 | 110 | 180 | 110 | 130 | 130 | 150 | 160 | 180 |
| Forestry and Logging | 200 | 220 | 240 | 230 | 250 | 260 | 290 | 260 | 280 | 290 |
| Fishing, Hunting and Trapping | 310 | 330 | 310 | 320 | 320 | 360 | 110 | 690 | 720 | 620 |
| Agriculture, Forestry and Fishing Support Services | 2,450 | 2,400 | 2,500 | 2,450 | 2,700 | 2,650 | 2,800 | 2,900 | 3,000 | 3,150 |
| **Total Agriculture, Forestry and Fishing** | **13,800** | **13,900** | **14,500** | **14,800** | **15,400** | **15,300** | **15,200** | **15,900** | **16,300** | **16,400** |
| **Total all Industry** | **255,100** | **255,300** | **257,100** | **264,300** | **277,700** | **285,900** | **289,800** | **293,000** | **303,400** | **305,300** |

*Source*: Statistics New Zealand (2020a).

Table 2.2 on the previous page presents the numbers of employees by sector in the Food and Fibre production industry in Canterbury. In 2019, 16,400 people were employed in agriculture, forestry and fishing. The largest number of employees was in dairy (5,300 employees), followed by sheep, beef cattle and grain (3,200 employees), then agriculture, forestry and fishing support services (3,150 employees).

Between 2010 and 2019 the employee count in agriculture, forestry and fishing has grown by 19 per cent. In the same period, the employee count in aquaculture and fishing, hunting and trapping has more than doubled. The number of employees in dairy farming grew by 36 per cent while the number of employees in sheep and beef and grain farming dropped by 6 per cent over the same period. Total employees in Canterbury increased by 20 per cent between 2010 and 2019.

## 2.3 Primary Processors

Many products from primary production must be processed before they can be sold to consumers. The processing industries are classified in the System of National Accounts as part of the manufacturing sector, but are clearly a necessary part of the Food and Fibre sector. Hence, the Food and Fibre processing sector is comprised of the following eight industries:

1. Meat & Meat Product Manufacturing;
2. Seafood Processing;
3. Dairy Product Manufacturing;
4. Fruit, Cereal and Other Food Product Manufacturing;
5. Beverage and Tobacco Product Manufacturing;
6. Textile, Leather, Clothing and Footwear manufacturing;
7. Wood Product Manufacturing; and
8. Pulp and Paper Product Manufacturing.

In 2019, 1,017 firms made up the Food and Fibre processing sector in Canterbury (see Table 2.3). The largest number of businesses was recorded in food manufacturing (408 businesses), followed by wood product manufacturing (273) then textile, leather, clothing and footwear manufacturing (225). Within the food and fibre processing sector, food manufacturing accounted for the largest number (40 per cent), followed by wood product manufacturing (27 per cent).

Within food manufacturing, the largest number of businesses were bakeries (138 businesses), representing 34 per cent of total food manufacturing businesses, followed by other food product manufacturing (120 businesses) representing 29 per cent of total food manufacturing businesses.

The number of businesses within the Food and Fibre Processing industry in Canterbury fluctuated between 2010 and 2019, but dropped by 4.5 per cent overall.

**Table 2.3 Number of Businesses in the Food and Fibre Production Industry, Canterbury, 2010–2019**

| **Industry (ANZIC06)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|
| Meat and Meat Product Manufacturing | 54 | 54 | 51 | 54 | 54 | 60 | 60 | 60 | 54 | 54 |
| Seafood Processing | 18 | 18 | 18 | 15 | 18 | 18 | 18 | 18 | 18 | 18 |
| Dairy Product Manufacturing | 24 | 24 | 21 | 27 | 24 | 30 | 24 | 27 | 24 | 27 |
| Fruit and Vegetable Processing | 15 | 15 | 18 | 15 | 15 | 18 | 15 | 15 | 18 | 21 |
| Oil and Fat Manufacturing | 6 | 9 | 9 | 9 | 9 | 9 | 12 | 9 | 6 | 9 |
| Grain Mill and Cereal Product Manufacturing | 12 | 12 | 9 | 12 | 9 | 12 | 12 | 12 | 12 | 12 |
| Bakery Product Manufacturing | 159 | 153 | 144 | 150 | 153 | 147 | 150 | 150 | 144 | 138 |
| Sugar and Confectionery Manufacturing | 21 | 21 | 21 | 18 | 15 | 15 | 12 | 12 | 9 | 9 |
| Other Food Product Manufacturing | 96 | 102 | 111 | 108 | 114 | 114 | 117 | 117 | 120 | 120 |
| **Food Product Manufacturing** | **399** | **405** | **402** | **405** | **417** | **420** | **423** | **420** | **405** | **408** |
| Beverage and Tobacco Product Manufacturing | 66 | 57 | 63 | 69 | 78 | 81 | 90 | 87 | 96 | 90 |
| Textile, Leather, Clothing and Footwear Manufacturing | 273 | 270 | 237 | 237 | 234 | 243 | 237 | 228 | 219 | 225 |
| Wood Product Manufacturing | 306 | 300 | 291 | 276 | 285 | 282 | 282 | 279 | 282 | 273 |
| Pulp, Paper and Converted Paper Product Manufacturing | 21 | 21 | 24 | 21 | 21 | 24 | 21 | 21 | 18 | 21 |
| **Total Food and Fibre Processing** | **1,065** | **1,053** | **1,017** | **1,008** | **1,035** | **1,050** | **1,053** | **1,035** | **1,020** | **1,017** |
| TOTAL Industry | **65,163** | **64,749** | **64,290** | **65,535** | **68,373** | **70,485** | **71,376** | **72,219** | **72,144** | **72,714** |

*Source*: Statistics New Zealand (2020a).

**Table 2.4 Employee Count in the Food and Fibre Production Industry, Canterbury, 2010–2019**

| **Industry (ANZIC06)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|
| Meat and Meat Product Manufacturing | 5,800 | 5,600 | 5,100 | 5,200 | 5,100 | 4,700 | 5,200 | 5,300 | 5,200 | 5,200 |
| Seafood Processing | 1,250 | 1,250 | 1,100 | 1,050 | 900 | 840 | 700 | 660 | 640 | 690 |
| Dairy Product Manufacturing | 1,050 | 1,150 | 1,300 | 1,300 | 1,650 | 1,950 | 2,150 | 1,950 | 2,350 | 2,550 |
| Fruit and Vegetable Processing | 1,050 | 890 | 1,050 | 1,050 | 1,100 | 960 | 950 | 1,000 | 1000 | 1,050 |
| Oil and Fat Manufacturing | 18 | 18 | 21 | 20 | 30 | 40 | 45 | 40 | 35 | 45 |
| Grain Mill and Cereal Product Manufacturing | 160 | 160 | 100 | 55 | 140 | 170 | 180 | 190 | 170 | 170 |
| Bakery Product Manufacturing | 2,200 | 2,000 | 2,000 | 2,150 | 2,000 | 2,100 | 2,050 | 2,100 | 2,150 | 2,100 |
| Sugar and Confectionery Manufacturing | 110 | 100 | 130 | 110 | 100 | 85 | 70 | 50 | 45 | 45 |
| Other Food Product Manufacturing | 630 | 670 | 720 | 690 | 770 | 740 | 720 | 700 | 730 | 690 |
| **Food Product Manufacturing** | **12,200** | **11,800** | **11,500** | **11,600** | **11,800** | **11,600** | **12,000** | **11,900** | **12,300** | **12,500** |
| Beverage and Tobacco Product Manufacturing | 540 | 570 | 440 | 570 | 550 | 550 | 440 | 500 | 700 | 790 |
| Textile, Leather, Clothing and Footwear Manufacturing | 2,300 | 2,300 | 1,950 | 1,950 | 1,950 | 1,700 | 1,550 | 1,500 | 1,450 | 1,450 |
| Wood Product Manufacturing | 2,100 | 2,050 | 1,950 | 2,050 | 2,150 | 2,250 | 2,200 | 2,250 | 2,250 | 2,150 |
| Pulp, Paper and Converted Paper Product Manufacturing | 390 | 390 | 290 | 360 | 270 | 370 | 350 | 340 | 360 | 390 |
| TOTAL Food and Fibre Processing | 17,530 | 17,110 | 16,130 | 16,530 | 16,720 | 16,470 | 16,540 | 16,490 | 17,060 | 17,280 |
| Total All Canterbury | **255,100** | **255,300** | **257,100** | **264,300** | **277,700** | **285,900** | **289,800** | **293,000** | **303,400** | **305,300** |

*Source*: Statistics New Zealand (2020a).

Table 2.4 on the previous page shows the number of employees by industry in the Canterbury Food and Fibre processing sector between 2010 and 2019. In 2019, 17,280 people were employed in the Food and Fibre processing industry. The largest number of employees were in food product manufacturing (12,500 employees), followed by wood product manufacturing (2,150 employees).

Within the food product manufacturing sector, the largest number of employees was in meat and meat product manufacturing (5,200 employees), followed by dairy product manufacturing (2,550 employees). Of note, the dairy product manufacturing has grown significantly between 2010 and 2019 with the employee numbers in this sector more than doubling (143 per cent) over that period.

Table 2.5 summarises the number of businesses and employees of Canterbury's Food and Fibre sector in 2019. This shows that 15 per cent of all Canterbury businesses are in the food and fibre sector and 11 per cent of employees.

**Table 2.5 Canterbury Food and Fibre Sector, 2019**

| | Number of Businesses | Number of Employees |
|---|---|---|
| Food and Fibre Production | 9,531 | 16,400 |
| Food and Fibre Processing | 1,017 | 17,280 |
| Food and Fibre Industry | 10,548 | 33,680 |
| Total all industries | **72,714** | **305,300** |

*Source*: Statistics New Zealand (2020a).

## 2.4 Exports

Exports are important for the New Zealand economy. In 2018, 95 per cent of New Zealand's milk production was exported, as well as over 90 per cent of sheepmeat and 80 per cent of the country's beef production.[5] Most food and fibre products exported from Canterbury (as well as some from elsewhere) are exported from region's three major ports: the sea ports of Lyttelton and Timaru and Christchurch International Airport.

Export data are available from the series published by Statistics New Zealand on Harmonised Trade – Exports. The Harmonised System is used by more than 190 other countries as a basis for their customs tariffs and for collecting international trade statistics. The dataset is detailed, comprising 21 sections, 98 chapters (2 digit), 1,229 headings (4 digit), and 5,394 sub-headings (6 digit). The research team scanned the 98 HS Codes (2-digit level) to identify 36 HS chapters relevant to the Food and Fibre Sector.

[5] Data from DCANZ (2020) and from MIA 2020).

Table 2.6 reports Food and Fibre exports by HS chapter passing through each Canterbury port in 2018. The total value of Food and Fibre exports shipped from all three Canterbury ports that year was $5.8 billion. The largest value was shipped from Lyttelton ($4.3 billion), followed by Timaru ($1.2 billion) and then Christchurch airport ($356 million). The largest share was for dairy produce (45 per cent), followed by meat and edible meat offal (14 per cent), then preparations of cereals, flour, starch or milk and pastry cooks' products (12 per cent). Exports of wood and articles of wood were 5 per cent of all food and fibre exports leaving the Canterbury ports in 2018.

In 2018, there was $4.3 billion of food and fibre exports shipped from Lyttelton port. These exports were mainly dairy produce (42 per cent), followed by preparations of cereals, flour, starch or milk; pastry cooks' products (16 per cent), then meat and edible meat offal (14 per cent). Exports of wood and articles of wood were 5 per cent of all food and fibre exports leaving the Canterbury ports in 2018.

From Timaru port a value of $1.2 billion food and fibre exports were exported in 2018. The majority of exports from this sector were dairy produce (66 per cent), followed by meat and edible meat offal (12 per cent), then wood and articles of wood; wood charcoal (8 per cent).

From Christchurch International Airport $356 million of food and fibre exports were shipped overseas in 2018. The largest share was fish and crustaceans, molluscs and other aquatic invertebrates (43 per cent), then Meat and edible meat offal (17 per cent), and then Fruit and nuts, edible; peel of citrus fruit or melons (11 per cent).

**Table 2.6 Food and Fibre Exports by Canterbury Port, 2018 (FOB NZ$000; HS Chapter 2)**

| | Christchurch Seaport (Lyttelton) | Christchurch Airport | Timaru | Total Canterbury Ports |
|---|---|---|---|---|
| Animals; live | … | 10,652 | 14,555 | 25,207 |
| Meat and edible meat offal | 591,595 | 60,119 | 138,924 | 790,638 |
| Fish and crustaceans, molluscs and other aquatic invertebrates | 175,406 | 152,946 | 47,873 | 376,225 |
| Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included | 1,823,228 | 14,738 | 769,195 | 2,607,161 |
| Animal originated products; not elsewhere specified or included | 72,218 | 2,945 | 8,014 | 83,177 |
| Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage | 18,835 | 275 | … | 19,110 |
| Vegetables and certain roots and tubers; edible | 73,509 | 404 | 11,060 | 84,972 |
| Fruit and nuts, edible; peel of citrus fruit or melons | 12,787 | 37,554 | 387 | 50,727 |
| Coffee, tea, mate and spices | 17 | 83 | … | 100 |
| Cereals | 370 | 23 | … | 392 |
| Products of the milling industry; malt, starches, inulin, wheat gluten | 11,261 | 186 | 337 | 11,785 |
| Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder | 101,535 | 7,388 | 3,597 | 112,520 |
| Lac; gums, resins and other vegetable saps and extracts | 78 | 97 | … | 175 |
| Vegetable plaiting materials; vegetable products not elsewhere specified or included | 1 | … | … | 1 |
| Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes | 6,372 | 3,376 | 37,630 | 47,378 |
| Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof | 8,373 | 15,397 | 85 | 23,855 |
| Sugars and sugar confectionery | 908 | 266 | 312 | 1,486 |
| Cocoa and cocoa preparations | 391 | 5 | 5 | 401 |
| Preparations of cereals, flour, starch or milk; pastrycooks' products | 669,785 | 25,278 | 55 | 695,119 |

| | Christchurch Seaport (Lyttelton) | Christchurch Airport | Timaru | Total Canterbury Ports |
|---|---|---|---|---|
| Preparations of vegetables, fruit, nuts or other parts of plants | 88,167 | 447 | 3,549 | 92,163 |
| Miscellaneous edible preparations | 19,088 | 3,904 | 2,529 | 25,521 |
| Beverages, spirits and vinegar | 27,089 | 1,638 | 6,576 | 35,304 |
| Food industries, residues and wastes thereof; prepared animal fodder | 29,552 | 1,018 | 4,790 | 35,360 |
| Tobacco and manufactured tobacco substitutes | 1,441 | 14 | … | 1,455 |
| Raw hides and skins (other than furskins) and leather | 26,780 | 3,646 | 9,734 | 40,160 |
| Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut) | 687 | 7,489 | … | 8,176 |
| Furskins and artificial fur; manufactures thereof | 22,796 | 2,688 | … | 25,484 |
| Wood and articles of wood; wood charcoal | 218,485 | 167 | 90,339 | 308,992 |
| Cork and articles of cork | … | 17 | … | 17 |
| Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork | 57 | 182 | … | 239 |
| Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard | 16,187 | … | 111 | 16,297 |
| Paper and paperboard; articles of paper pulp, of paper or paperboard | 609 | 2,376 | 20 | 3,005 |
| Silk | 0 | 11 | … | 11 |
| Wool, fine or coarse animal hair; horsehair yarn and woven fabric | 297,709 | 743 | 18,391 | 316,843 |
| Cotton | 14 | 62 | … | 76 |
| Vegetable textile fibres; paper yarn and woven fabrics of paper yarn | 0 | 22 | … | 22 |

*Source*: Statistics New Zealand (2020b).

# Chapter 3

# Economic Indicators for the Canterbury Food and Fibre Sector

## 3.1 Introduction

This chapter presents a wider set of statistical indicators to describe the Food and Fibre Sector in the Canterbury economy. This includes the contribution to Canterbury's Gross Domestic Product (GDP), including the contribution of inputs into the sector. The chapter also presents Census data on the sector's employment and income, before a final section describing land use in the region.

## 3.2 Contribution to Gross Domestic Product

Gross Domestic Product (GDP) is a statistical indicator of the size of a regional or national economy. Statistics New Zealand estimates Gross Domestic Product (GDP) by region and by sector. Table 3.1 uses those estimates to present GDP for the Canterbury region between 2012 and 2017, analysed by industry.

In 2017, the agricultural sector contributed $2 billion to Canterbury's regional GDP, which was 6 per cent. Forestry, fishing and mining contributed a further $516 million (2 per cent). Primary manufacturing contributed $2.2 billion (a further 6 per cent).

Table 3.1 also shows that between 2012 and 2017, Canterbury's agricultural sector grew by 4 per cent. Fishing, forestry, and mining grew by 15 per cent from a much smaller base. Primary manufacturing, grew by 16 per cent.

To evaluate the total economic impact of the Food and Fibre sector in Canterbury, it is important to recognise that the production and processing industries require inputs from other parts of the economy (specialist transport such as milk tankers or livestock carriers, for example). Further, people employed in production, processing or supporting industries use their income to purchase goods and services more generally.

Economists therefore use multiplier analysis to calculate three types of impacts from a major sector like Food and Fibre production and processing.

1. *Direct impact* – this is the economic value of the Food and Fibre production and processing sectors.
2. *Indirect impact* – this is the economic value of the goods and services supplied by other industries as inputs into the Food and Fibre sector.
3. *Induced impact* – this is the flow on impact of the above two contributions on further household spending, which generates revenue as a result of increased purchases of household goods and services.

**Table 3.1 Gross Domestic Product by Industry, Canterbury, $million, Years Ending March, 2012–2017**

| Sector | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Agriculture | 1,939 | 1,698 | 2,510 | 1,495 | 1,366 | 2,006 |
| Fishing, forestry, and mining | 448 | 397 | 400 | 471 | 474 | 516 |
| Electricity, gas, water, and waste services | 704 | 838 | 976 | 1,013 | 1,047 | 1,031 |
| Primary manufacturing | 1,889 | 1,880 | 1,947 | 2,279 | 2,611 | 2,199 |
| Other manufacturing | 1,367 | 1,369 | 1,323 | 1,436 | 1,480 | 1,525 |
| Construction | 1,849 | 2,320 | 2,750 | 3,176 | 3,311 | 3,140 |
| Wholesale trade | 1,216 | 1,173 | 1,357 | 1,490 | 1,578 | 1,596 |
| Retail trade | 1,191 | 1,297 | 1,441 | 1,492 | 1,524 | 1,608 |
| Accommodation | 199 | 191 | 174 | 185 | 237 | 244 |
| Food and beverage services | 341 | 373 | 391 | 438 | 465 | 489 |
| Transport, postal, and warehousing | 1,232 | 1,329 | 1,397 | 1,611 | 1,722 | 1,709 |
| Financial and insurance services | 797 | 880 | 997 | 1,058 | 931 | 846 |
| Rental, hiring, and real estate services | 1,900 | 1,938 | 2,209 | 2,257 | 2,303 | 2,429 |
| Owner-occupied property operation | 1,813 | 2,016 | 2,240 | 2,421 | 2,388 | 2,325 |
| Professional, scientific, and technical services | 1,821 | 1,986 | 2,209 | 2,384 | 2,508 | 2,672 |
| Administrative and support services | 472 | 486 | 486 | 534 | 538 | 519 |
| Public administration, defence, and safety | 853 | 849 | 871 | 923 | 1,002 | 1,037 |
| Education and training | 1,166 | 1,173 | 1,219 | 1,277 | 1,311 | 1,396 |
| Health care and social assistance | 1,722 | 1,768 | 1,864 | 1,894 | 2,036 | 2,099 |
| Information media and telecommunications and other services | 1,328 | 1,354 | 1,350 | 1,407 | 1,424 | 1,513 |
| GST on production, import duties, and other taxes | 2,221 | 2,351 | 2,544 | 2,672 | 2,807 | 2,941 |
| **Gross Domestic Product** | **26,468** | **27,666** | **30,654** | **31,911** | **33,062** | **33,843** |

*Notes*: Figures may not sum to totals due to rounding. Canterbury includes Chatham Islands.

*Source*: Statistics New Zealand (2020c).

Geoff Butcher (2013) has calculated multipliers for this purpose, using data published by Statistics New Zealand in their 2012-13 Input-Output tables. Regional GDP data does not analyse the contribution from agriculture shown in Table 3.1 by agricultural industries. The research team therefore used percentage shares from the national Input-Output tables and applied these to obtain regional estimates.

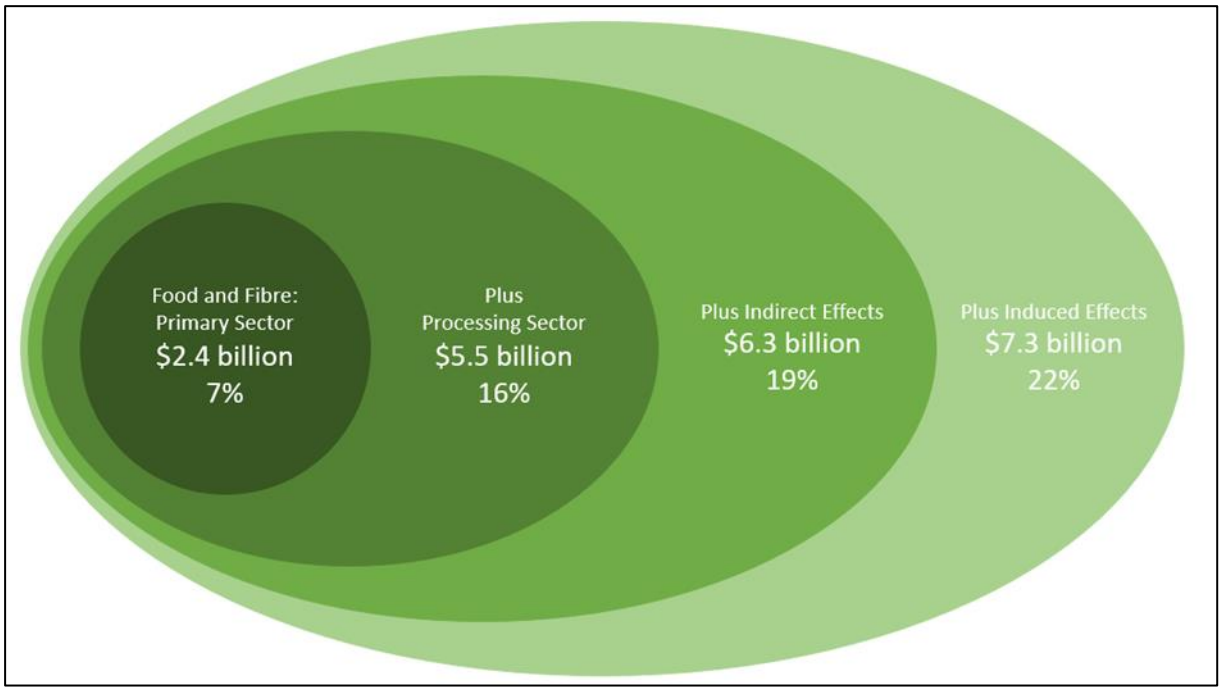
Figure 3.1 shows the importance of the Food and Fibre sector for the regional economy including the direct, indirect and induced effects. It begins by estimating the value added by the Food and Fibre primary production sector, which were estimated at $2.4 billion, or 7 per cent of gross domestic product (GDP).

It then includes the value added by the Food and Fibre processing industries, which were estimated at a further $3.1 billion. This increases the contribution to $5.5 billion, or 16 per cent of regional GDP.

The indirect impact of the production and processing activities on the value added of other industries was estimated to have been $860 million, which brings the total contribution to $6.3 billion, or 19 per cent of GDP. This estimate indicates that for every $5 of value created in the Canterbury economy, nearly $1 comes from direct and indirect impacts of the food and fibre sector.

Finally, the induced impact currently produced by the Food and Fibre sector was estimated to be a further $981 million, so that the total impact is $7.3 billion, or 22 per cent of GDP. This last impact is generally downplayed by economists, since the food and fibre sector disappeared, other forms of economic activity would take its place, resulting in the same induced effects.

**Figure 3.1 Contribution of the Food and Fibre Sector to Canterbury GDP, 2017**




*Source*: AERU calculations, using multipliers provided in Butcher (2013).

## 3.3 Related Services

The previous section estimated the total indirect impacts of the Food and Fibre production and processing sectors on other industries providing goods and services as inputs. This section provides further analysis by industry, again using Geoff Butcher's (2013) calculations. These provide for each of the sectors the value and type of inputs and the associated number of employees.

Tables 3.2 and 3.3 present the results for the production and processing sectors respectively. The greatest inputs into the production sector are fertiliser and pesticide manufacturing, especially for pastoral farming. This is followed by banking and finance, then construction and then legal and accountancy services for dairy. In the case of meat, it is road transport, banking and finances and then basic material manufacturing.

The inputs into the other sectors are lower. For horticulture, these are polymer product and rubber manufacturing, followed by fertiliser and pesticide manufacturing and then road transport. For forestry, the greatest input is road transport; for fishing it is rental and hiring services and for other livestock farming it is fertiliser and pesticide manufacturing.

The greatest inputs into the processing sector is road transport, especially for the meat and dairy processing but also for fruit, oil cereals and other food product manufacturing and the wood manufacturing sectors. In the meat processing sector rental and hiring services are also relatively large. In dairy manufacturing it is polymer product and rubber product manufacturing.

## 3.4 Employment

This section reports on employment statistics from Census 2006 and Census 2013 which provides the most recent population data for Canterbury to date. The release of regional data from the 2018 Census is still in preparation.

Table 3.4 presents data for the Food and Fibre primary production and primary processing sectors, using Statistics New Zealand data based on subdivisions in the ANZSIC06 industry classification system. The table shows the numbers employed full-time and part-time, as self-reported in the 2006 and 2013 Censuses. Full-time employment in the sector is dominated by male employees, while there are more female employees than male employees in part-time employment.

Employment in the primary production industries remained static between the two census dates, changing from 18,768 in 2006 to 18,882 in 2013. There was a decline in the number of people employed in the processing industries, from 16,332 to 13,815. Most of this decline was caused by fewer jobs in textile, leather, clothing and footwear manufacturing.

**Table 3.2 Related Services to the Food and Fibre Production Industry, Canterbury, $000, 2013**

| Industry | Horticulture and fruit growing | Sheep, beef cattle, and grain farming | Dairy cattle farming | Poultry, deer, and other livestock farming | Forestry and logging | Fishing and aquaculture | Agriculture, forestry, and fishing support services |
|---|---|---|---|---|---|---|---|
| Fertiliser and pesticide manufacturing | 9,078 | 59,576 | 60,643 | 6,303 | 341 | 0 | 486 |
| Polymer product and rubber product manufacturing | 11,046 | 3,837 | 5,349 | 883 | 130 | 827 | 116 |
| Electricity generation and on-selling | 1,258 | 5,718 | 15,537 | 2,085 | 162 | 385 | 862 |
| Construction services | 2,719 | 15,112 | 31,526 | 2,706 | 1,495 | 2,487 | 3,672 |
| Basic material wholesaling | 3,601 | 19,355 | 24,690 | 2,910 | 670 | 1,277 | 953 |
| Machinery and equipment wholesaling | 2,876 | 7,809 | 17,150 | 2,843 | 1,909 | 2,935 | 4,272 |
| Grocery, liquor, and tobacco product wholesaling | 3,376 | 7,227 | 12,829 | 1,927 | 1,032 | 2,049 | 918 |
| Other goods and commission based wholesaling | 2,832 | 15,344 | 23,204 | 3,417 | 457 | 1,817 | 915 |
| Road transport | 6,309 | 23,871 | 12,554 | 5,403 | 24,763 | 1,744 | 4,393 |
| Transport support services | 1,299 | 2,320 | 2,434 | 534 | 6,817 | 3,957 | 583 |
| Banking and financing | 4,289 | 22,096 | 33,048 | 3,201 | 1,557 | 802 | 1,647 |
| Health and general insurance | 2,121 | 8,237 | 9,577 | 2,035 | 0 | 866 | 2,666 |
| Rental and hiring services; non-financial asset leasing | 3,874 | 18,631 | 7,820 | 1,525 | 1,334 | 12,043 | 7,867 |
| Non-residential property operation | 7,547 | 18,705 | 24,470 | 4,111 | 6,487 | 687 | 2,308 |
| Scientific, architectural, and engineering services | 589 | 4,293 | 18,753 | 2,071 | 485 | 220 | 1,356 |
| Legal and accounting services | 3,084 | 15,775 | 28,202 | 2,511 | 1,123 | 1,259 | 2,702 |
| Veterinary and other professional services | 650 | 3,099 | 7,838 | 1,070 | 66 | 209 | 818 |
| Employment and other administrative services | 5,847 | 2,250 | 7,588 | 1,554 | 763 | 404 | 1,244 |
| Building cleaning, pest control, and other support services | 9,394 | 16,487 | 24,251 | 3,164 | 175 | 185 | 5,698 |
| Repair and maintenance | 2,234 | 6,073 | 9,468 | 2,238 | 1,236 | 6,543 | 7,327 |

*Source*: AERU calculations, using multipliers provided in Butcher (2013).

**Table 3.3 Related Services to the Food and Fibre Processing Industry, Canterbury, $000, 2013**

| Industry | Meat and meat product manu-facturing | Seafood processing | Dairy product manu-facturing | Fruit, cereal, and other food product manu-facturing | Beverage and tobacco product manu-facturing | Textile, Leather, Clothing & Footwear manu-facturing | Wood product manu-facturing | Pulp and paper product manu-facturing |
|---|---|---|---|---|---|---|---|---|
| Fertiliser and pesticide manufacturing | 1,924 | 227 | 394 | 1,537 | 478 | 385 | 379 | 131 |
| Polymer product and rubber product manufacturing | 12,836 | 1,729 | 37,304 | 9,765 | 8,327 | 2,641 | 4,340 | 1,441 |
| Electricity generation and on-selling | 9,627 | 1,745 | 9,173 | 5,155 | 646 | 1,238 | 4,567 | 7,392 |
| Construction services | 6,748 | 3,074 | 2,465 | 5,743 | 2,349 | 890 | 4,353 | 891 |
| Basic material wholesaling | 4,977 | 2,670 | 3,737 | 7,163 | 1,875 | 5,357 | 7,695 | 2,709 |
| Machinery and equipment wholesaling | 17,042 | 5,729 | 3,792 | 12,017 | 3,387 | 5,001 | 10,042 | 3,618 |
| Grocery, liquor, and tobacco product wholesaling | 10,576 | 3,214 | 9,183 | 10,649 | 2,902 | 3,503 | 4,541 | 2,298 |
| Other goods and commission based wholesaling | 5,128 | 3,420 | 3,411 | 10,944 | 2,173 | 6,712 | 4,132 | 3,744 |
| Road transport | 57,306 | 4,331 | 57,686 | 32,052 | 4,322 | 7,898 | 18,179 | 6,276 |
| Transport support services | 17,133 | 1,525 | 8,956 | 4,428 | 787 | 1,886 | 8,017 | 2,525 |
| Banking and financing; financial asset investing | 3,775 | 1,259 | 5,589 | 2,844 | 1,179 | 1,500 | 1,872 | 527 |
| Health and general insurance | 4,888 | 1,585 | 1,180 | 2,045 | 886 | 1,191 | 2,146 | 1,706 |
| Rental and hiring services; non-financial asset leasing | 51,985 | 10,729 | 12,157 | 6,849 | 3,440 | 1,538 | 2,081 | 473 |
| Non-residential property operation | 7,942 | 2,155 | 5,270 | 10,414 | 3,388 | 5,088 | 3,206 | 347 |
| Scientific, architectural, and engineering services | 7,105 | 230 | 6,669 | 1,561 | 901 | 736 | 1,413 | 868 |
| Legal and accounting services | 6,600 | 878 | 1,017 | 1,735 | 1,255 | 1,855 | 2,325 | 827 |
| Veterinary and other professional services | 673 | 218 | 632 | 616 | 197 | 451 | 243 | 126 |
| Employment and other administrative services | 3,584 | 845 | 9,053 | 2,982 | 2,797 | 2,462 | 3,181 | 673 |
| Building cleaning, pest control, and other support services | 7,909 | 968 | 5,155 | 1,748 | 1,340 | 509 | 1,295 | 112 |
| Repair and maintenance | 8,092 | 4,334 | 2,774 | 3,478 | 1,236 | 1,071 | 4,707 | 1,322 |

*Source*: AERU calculations, using multipliers provided in Butcher (2013).

**Table 3.4 Employment in the Food and Fibre Sector, Canterbury, 2006 and 2013**

| | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| **FULL-TIME EMPLOYMENT** | **2006** | **2013** | **2006** | **2013** | **2006** | **2013** |
| Agriculture | 8,673 | 9,030 | 3,252 | 3,255 | 11,928 | 12,285 |
| Aquaculture | 75 | 81 | 18 | 21 | 96 | 102 |
| Forestry and logging | 279 | 255 | 48 | 57 | 324 | 309 |
| Fishing, hunting and trapping | 225 | 165 | 75 | 36 | 300 | 198 |
| Agriculture, forestry and fishing support services | 1,743 | 1,548 | 375 | 342 | 2,118 | 1,893 |
| *TOTAL PRIMARY PRODUCTION* | *10,995* | *11,079* | *3,768* | *3,711* | *14,766* | *14,787* |
| Food product manufacturing | 5,844 | 5,391 | 2,613 | 2,655 | 8,457 | 8,046 |
| Beverage and tobacco product manufacturing | 294 | 318 | 102 | 120 | 399 | 438 |
| Textile, leather, clothing and footwear manufacturing | 1,518 | 723 | 1,710 | 840 | 3,225 | 1,560 |
| Wood product manufacturing | 1,656 | 1,536 | 240 | 228 | 1,896 | 1,761 |
| Pulp, paper and converted paper product manufacturing | 309 | 285 | 60 | 63 | 369 | 351 |
| *TOTAL PRIMARY PROCESSING* | *9,621* | *8,253* | *4,725* | *3,906* | *14,346* | *12,156* |
| **TOTALS** | **20,616** | **19,332** | **8,493** | **7,617** | **29,112** | **26,943** |
| **PART-TIME EMPLOYMENT** | | | | | | |
| Agriculture | 1,215 | 1,335 | 2,214 | 2,253 | 3,429 | 3,588 |
| Aquaculture | 18 | 12 | 9 | 6 | 27 | 15 |
| Forestry and logging | 36 | 27 | 33 | 27 | 66 | 54 |
| Fishing, hunting and trapping | 30 | 24 | 27 | 18 | 57 | 42 |
| Agriculture, forestry and fishing support services | 168 | 168 | 264 | 234 | 435 | 399 |
| *TOTAL PRIMARY PRODUCTION* | *1,467* | *1,566* | *2,547* | *2,538* | *4,014* | *4,098* |
| Food product manufacturing | 369 | 357 | 723 | 672 | 1,092 | 1,032 |
| Beverage and tobacco product manufacturing | 27 | 39 | 60 | 63 | 90 | 99 |
| Textile, leather, clothing and footwear manufacturing | 93 | 48 | 429 | 270 | 522 | 315 |
| Wood product manufacturing | 105 | 78 | 144 | 105 | 249 | 180 |
| Pulp, paper and converted paper product manufacturing | 12 | 9 | 30 | 15 | 42 | 24 |
| *TOTAL PRIMARY PROCESSING* | *606* | *531* | *1,386* | *1,125* | *1,995* | *1,650* |
| **TOTALS** | **2,073** | **2,097** | **3,933** | **3,663** | **6,009** | **5,748** |

**Table 3.4 (Continued) Employment in the Food and Fibre Sector, Canterbury, 2006 and 2013**

| | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| **TOTAL EMPLOYMENT** | **2006** | **2013** | **2006** | **2013** | **2006** | **2013** |
| Agriculture | 9,891 | 10,365 | 5,463 | 5,508 | 15,354 | 15,870 |
| Aquaculture | 96 | 90 | 27 | 27 | 120 | 117 |
| Forestry and logging | 312 | 279 | 78 | 84 | 390 | 363 |
| Fishing, hunting and trapping | 258 | 186 | 99 | 54 | 354 | 240 |
| Agriculture, forestry and fishing support services | 1,911 | 1,713 | 639 | 579 | 2,550 | 2,292 |
| *TOTAL PRIMARY PRODUCTION* | *12,468* | *12,633* | *6,306* | *6,252* | *18,768* | *18,882* |
| Food product manufacturing | 6,213 | 5,748 | 3,336 | 3,330 | 9,549 | 9,078 |
| Beverage and tobacco product manufacturing | 327 | 357 | 165 | 186 | 489 | 540 |
| Textile, leather, clothing and footwear manufacturing | 1,608 | 768 | 2,136 | 1,107 | 3,744 | 1,878 |
| Wood product manufacturing | 1,758 | 1,614 | 384 | 330 | 2,142 | 1,944 |
| Pulp, paper and converted paper product manufacturing | 321 | 294 | 90 | 81 | 408 | 375 |
| *TOTAL PRIMARY PROCESSING* | *10,227* | *8,781* | *6,111* | *5,034* | *16,332* | *13,815* |
| **TOTALS** | **22,695** | **21,414** | **12,417** | **11,286** | **35,100** | **32,697** |

*Source*: Statistics New Zealand Census Data.

## 3.5 Income

In 2018, 22,287 people were receiving either wages/salaries or earnings from self-employment in the agriculture, forestry, and fishing sector with a median earning of $36,960 (see Table 3.5). This was 16,053 earning wages/salaries and 6,234 self-employed in the agriculture, forestry, and fishing sector in 2018.

The median earnings for wages/salaries in 2018 was $36,960 while the median earnings through self-employment was $48,000. Comparing earnings from 2010 to those in 2018, the total median earning increased by 47 per cent in the agriculture, forestry, and fishing sector. In more detail, the median wages/ salaries increased by 36 per cent and the median earning through self-employment increased by 72 per cent over that period.

**Table 3.5 Main Earnings Source in Agriculture, Forestry, and Fishing, Canterbury, $ per Year, Year Ending March, 2010–2018**

| Year | Total earnings | | Wages and salaries | | Self-employment | |
|---|---|---|---|---|---|---|
| | Count of People | Median Earnings | Count of People | Median Earnings | Count of People | Median Earnings |
| 2018 | 22,287 | 36,960 | 16,053 | 32,400 | 6,234 | 48,000 |
| 2017 | 21,810 | 34,750 | 15,270 | 31,950 | 6,540 | 41,660 |
| 2016 | 21,378 | 33,430 | 14,781 | 32,250 | 6,594 | 36,660 |
| 2015 | 21,834 | 34,180 | 14,730 | 31,270 | 7,104 | 41,440 |
| 2014 | 21,852 | 34,450 | 14,262 | 29,480 | 7,590 | 46,260 |
| 2013 | 21,315 | 32,340 | 13,809 | 28,840 | 7,506 | 41,800 |
| 2012 | 21,237 | 32,130 | 13,386 | 27,430 | 7,851 | 43,470 |
| 2011 | 21,108 | 28,470 | 13,380 | 25,130 | 7,728 | 35,960 |
| 2010 | 20,913 | 25,150 | 13,248 | 23,890 | 7,662 | 27,870 |

*Source*: Statistics New Zealand (2019a).

## 3.6 Land Use

This section outlines agriculture and land use statistics in Canterbury. Where appropriate, it compares regional data with New Zealand data, drawing on the Agricultural Production Census in 2012 and 2017. It is noted that this census data excludes New Zealand's conservation estate. The following subsections focus on agriculture, forestry and viticulture.

### *3.6.1 Agriculture*

Table 3.6 shows that in 2016, the total agricultural area in Canterbury was 2,595,880 hectares, which is a decline of 18 per cent between 2010 and 2016. In 2016, 66 per cent of agricultural land use was sheep and beef and 16 per cent for dairy farming. Between 2010 and 2016 the area used for dairy farming more than doubled (+155 per cent), while the area used for sheep and beef dropped by almost a third. Grain growing also increased by 57 per cent over the period with other land uses falling.

**Table 3.6 Agricultural Area by Usage (Hectares), Canterbury, Year Ending June, 2002–2016**

| | 2002 | 2007 | 2012 | 2016 | % Change 2010 - 2016 |
|---|---|---|---|---|---|
| Dairy | 164,570 | 226,825 | 347,164 | 419,078 | 155% |
| Sheep and Beef | 2,551,503 | 2,349,426 | 1,946,946 | 1,723,270 | -32% |
| Other Livestock | 134,148 | 135,390 | 104,730 | 111,710 | -17% |
| Forestry | 115,556 | 134,039 | 129,815 | 94,453 | -18% |
| Fruit and berry | 7,418 | 8,606 | 8,686 | 5,380 | -27% |
| Vegetable growing | 35,280 | 26,963 | 25,562 | 24,596 | -30% |
| Grain growing | 137,723 | 194,363 | 228,887 | 216,344 | 57% |
| Other | 4,693 | 4,649 | 0 | 1,049 | -78% |
| **Total** | **3,150,891** | **3,080,261** | **2,791,790** | **2,595,880** | **-18%** |

*Source*: Statistics New Zealand (2019b).

**Table 3.7 Irrigated Land, Canterbury and New Zealand (Hectares), Year Ending June, 2012 and 2017**

| | | Canterbury | New Zealand |
|---|---|---|---|
| **Total** | **2012** | 444,800 | 721,700 |
| | **2017** | 478,100 | 746,700 |
| | **% change** | 7.5 | 3.5 |
| **Flood systems** | **2012** | 47,900 | 94,500 |
| | **2017** | 14,900 | 39,300 |
| | **% change** | -69.0 | -58.4 |
| **Spray systems** | **2012** | 392,100 | 579,500 |
| | **2017** | 453,100 | 643,700 |
| | **% change** | 15.5 | 11.1 |
| **Micro systems** | **2012** | 5,000 | 45,900 |
| | **2017** | 8,300 | 57,100 |
| | **% change** | 66.3 | 24.4 |

*Source*: Statistics New Zealand (2018).

Table 3.7 shows a summary of irrigated land in Canterbury and New Zealand. This shows that Canterbury accounts for a large percentage of irrigated are in New Zealand. The highest proportion of land is irrigated by spray systems, accounting 95 per cent, followed by 3 per cent irrigated by flood systems. Table 3.7 also shows the increase in spray irrigation as in 2012, it was 88 per cent irrigated by spray systems and 11 per cent irrigated by flood systems.

Livestock numbers by type in Canterbury and New Zealand are given in Table 3.8. In 2018, sheep, dairy cattle and beef cattle were the main livestock in Canterbury. This also shows that Canterbury accounts for 21 per cent of New Zealand's dairy cattle, 16 per cent of sheep and 14 per cent of beef cattle in New Zealand. Between 2008 and 2018 most livestock numbers in Canterbury dropped, especially sheep and lambs dropping by 27 and 38 per cent. In contrast, the number of dairy cattle increased by 60 per cent.

**Table 3.8 Livestock Numbers in Canterbury and New Zealand, Year Ending June, 2008 and 2018**

| | Canterbury | | | New Zealand | | |
|---|---|---|---|---|---|---|
| | **2008** | **2018** | **% change** | **2008** | **2018** | **% change** |
| Beef cattle | 533,665 | 512,260 | -4.0% | 4,136,872 | 3,721,262 | -10.0% |
| Dairy cattle | 831,666 | 1,326,513 | 59.5% | 5,578,440 | 6,385,541 | 14.5% |
| Sheep | 6,063,300 | 4,423,195 | -27.0% | 34,087,864 | 27,295,749 | -19.9% |
| Lambs | 5,256,713 | 3,280,699 | -37.6% | 31,020,153 | 24,707,163 | -20.4% |
| Deer | 340,882 | 253,162 | -25.7% | 1,223,324 | 851,424 | -30.4% |
| Pigs | 177,306 | 185,924 | 4.9% | 324,594 | 287,051 | -11.6% |
| Horses | 11,755 | 6,704 | -43.0% | 62,511 | 40,525 | -35.2% |

*Source*: Statistics New Zealand (2019d).

Tables 3.9 and 3.10 give an analysis of the dairy cattle herds and their production in Canterbury and New Zealand for 2017/18. Table 3.9 shows that 37 per cent of the dairy herds in the South Island were in Canterbury. The average herd size in Canterbury was 797 cows which was significantly higher than the national average of 431 cows. In 2017/18 the average farm size was 232 effective hectares in Canterbury. This was higher than the average farm size of 214 effective hectares in the South Island and the average farm size of 151 effective hectares for all of New Zealand.

**Table 3.9 Herd Size in Canterbury, South Island and New Zealand, 2017/18**

| | **North Canterbury** | **South Canterbury** | **Total Canterbury** | **South Island** | **New Zealand** |
|---|---|---|---|---|---|
| **No of herds** | 874 | 317 | 1191 | 3213 | 11590 |
| **Total cows** | 701,464 | 250,899 | 952,363 | 2,040,692 | 4,992,914 |
| **Total effective hectares** | 204,227 | 72,931 | 277,158 | 688,610 | 1,755,148 |
| **Average herd size** | 803 | 791 | 797 | 635 | 431 |
| **Average effective hectare** | 234 | 230 | 232 | 214 | 151 |
| **Average cows per hectare** | 3.43 | 3.44 | 3.435 | 2.96 | 2.84 |

*Source*: LIC and DairyNZ (2018).

Table 3.10 analyses dairy production in Canterbury and New Zealand in 2017/18. On almost all measures, dairy productivity in Canterbury was higher than in the South Island and in New Zealand. In 2017/18 in Canterbury 388 million kilo milksolids were produced which is 17 per cent of total kg milksolids produced nationally. In the same year, the average kg milksolids per cow was 403kg in Canterbury and the average milksolids production per hectare was 1,385 kg.

**Table 3.10 Dairy Production in Canterbury and New Zealand, 2017/18**

| | North Canterbury | South Canterbury | Total Canterbury | South Island | New Zealand |
|---|---|---|---|---|---|
| Total kg milksolids | 289,940,204 | 98,477,041 | 388,417,245 | 809,884,624 | 1,839,714,208 |
| Average litres per herd | 3,754,732 | 3,485,163 | 3,619,948 | 2,825,382 | 1,788,051 |
| Average kg milkfat per herd | 184,746 | 173,059 | 178,903 | 140,739 | 89,320 |
| Average kg protein per herd | 146,993 | 137,594 | 142,294 | 111,326 | 69,413 |
| Average kg milksolids per herd | 331,739 | 310,653 | 321,196 | 252,065 | 158,733 |
| Average kg milkfat per effective ha | 791 | 752 | 771.5 | 657 | 590 |
| Average kg protein per effective ha | 629 | 598 | 613.5 | 519 | 458 |
| Average kg milksolids per effective ha | 1,420 | 1,350 | 1,385 | 1,176 | 1,048 |
| Average kg milkfat per cow | 230 | 219 | 224.5 | 222 | 207 |
| Average kg protein per cow | 183 | 174 | 178.5 | 175 | 161 |
| Average kg milksolids per cow | 413 | 392 | 402.5 | 397 | 368 |

*Source*: LIC and DairyNZ (2018).

Table 3.11 shows the production of selected fruit and vegetables in Canterbury and New Zealand in 2007 and 2017. The table shows that in 2017, the largest area was potatoes (4,332 hectares), followed by wine grapes (1,769 hectares). For most categories the production area in Canterbury increased whereas it decreased in New Zealand showing the growing importance of Canterbury to the horticultural sector with exception of the area under grapes and olives.

**Table 3.11 Horticultural Production in Canterbury and New Zealand (Hectares), Year Ending June, 2007 and 2017**

| | Canterbury | | | New Zealand | | |
|---|---|---|---|---|---|---|
| | 2007 | 2017 | % change | 2007 | 2017 | % change |
| Apples | 249 | 312 | 25% | 9,247 | 8,615 | -7% |
| Wine grapes | 1,683 | 1,769 | 5% | 29,616 | 33,981 | 15% |
| Olives | 437 | 133 | -70% | 2,173 | 921 | -58% |
| Onions | 686 | 1,001 | 46% | 4,594 | 6,009 | 31% |
| Potatoes | 4,273 | 4,332 | 1% | 10,050 | 9,450 | -6% |
| Squash | .. | 87 | | 7774 | 5,794 | -25% |

*Source*: Statistics New Zealand (2018).

There are a range of arable crops produced in the Canterbury region as shown in Table 3.12. Canterbury is by far the most important region in New Zealand for arable crops accounting for in 2017 87 per cent of wheat production and 66 per cent of barley production.

**Table 3.12 Arable Crops in Canterbury and New Zealand (Tonnes and Hectares), Year Ending June, 2007 and 2017**

| | | | Canterbury | New Zealand |
|---|---|---|---|---|
| Wheat | Tonnes | 2007 | 302,129 | 344,434 |
| | | 2017 | 347,300 | 405,200 |
| | | % change | 15% | 18% |
| | Hectares | 2007 | 35,301 | 40,538 |
| | | 2017 | 34,900 | 41,100 |
| | | % change | -1.1% | 1.4% |
| Barley | Tonnes | 2007 | 248,587 | 335,627 |
| | | 2017 | 196,300 | 297,600 |
| | | % change | -21.0% | -11.3% |
| | Hectares | 2007 | 36,869 | 51,481 |
| | | 2017 | 26,600 | 42,000 |
| | | % change | -27.9% | -18.4% |
| Maize grain | Tonnes | 2007 | 5,410 | 185,627 |
| | | 2017 | 4,500 | 175,600 |
| | | % change | -0.2 | -0.1 |
| | Hectares | 2007 | 432 | 17,030 |
| | | 2017 | 400 | 17,500 |
| | | % change | -0.1 | 0.0 |

*Source*: Statistics New Zealand (2018).

### *3.6.2 Forestry*

Canterbury has an area of 94,782 hectares of forest with a standing volume of 26,474 cubic metres (Table 3.13). The average age was 21.1 years which is older than the average age of forests in the South Island (18.8 years) and New Zealand (17.9 years). Canterbury forests accounted for 19 per cent of forest area in the South Island.

**Table 3.13 Area, Standing Volume and Area Weighted Average Age, Canterbury and New Zealand, 2019**

| | Area (ha) | Standing Volume (000m3) | Area Weighted Average Age (years) |
|---|---|---|---|
| North Island | 1,195,775 | 370,522 | 17.5 |
| Canterbury | 94,782 | 26,474 | 21.1 |
| South Island | 500,809 | 124,097 | 18.8 |
| New Zealand | 1,696,584 | 494,618 | 17.9 |

*Source*: Forestry New Zealand (2019).

Table 3.14 shows that in 2019, there were around 1,699 owners with more 40 hectares of forests in New Zealand. Nine per cent (157 owners) of these were located in Canterbury. The majority of forest owners (46 per cent) in Canterbury have 100-499 ha sized forests.

**Table 3.14 Number of Forest Owners by National Size Class, Canterbury and New Zealand, 2019**

| Wood Supply Region | Canterbury | New Zealand |
|---|---|---|
| 40-99 ha | 71 | 841 |
| 100-499 ha | 73 | 651 |
| 500-999 ha | 5 | 85 |
| 1000-9999 ha | 7 | 94 |
| 10,000 + ha | 1 | 28 |
| Total | 157 | 1,699 |

*Source*: Forestry New Zealand (2019).

Table 3.15 shows forestry planting and harvesting in Canterbury and New Zealand in 2012 and 2017. In 2017, an area of 1,600 hectares were replanted in Canterbury which is 6 per cent less than in 2012. In the same year, an estimated 3,100 hectares of roundwood were harvested from Canterbury's forests. This was 86 per cent more than in 2012 and compares to national area harvested of 52,300 hectares in the same year.

**Table 3.15 Forestry Planting and Harvesting, Canterbury and New Zealand, Year Ending March, 2012 and 2017**

| | | | | Canterbury | New Zealand |
|---|---|---|---|---|---|
| Exotic planting | New area | 2012 | (Hectares) | 700 | 11,300 |
| | | 2017 | | 600 | 5,300 |
| | | % change | | -21.6 | -53.0 |
| | Replanted | 2012 | (Hectares) | 1,700 | 40,200 |
| | | 2017 | | 1,600 | 42,000 |
| | | % change | | -6.6 | 4.3 |
| Exotic harvesting | | 2012 | (Hectares) | 1,600 | 48,200 |
| | | 2017 | | 3,100 | 52,300 |
| | | % change | | 86.1 | 8.4 |
| | | 2012 | (Cubic metres) | 761,000 | 25,201,200 |
| | | 2017 | | 1,278,100 | 25,912,000 |
| | | % change | | 67.9 | 2.8 |

*Source*: Statistics New Zealand (2018).

### *3.6.3 Viticulture*

The Canterbury wine region spans nearly 200km of the South Island's eastern coastline. Vineyards were first established on the Canterbury Plains in 1978, with plantings to the south-west of Christchurch and North Canterbury following close behind. Canterbury vines are planted from Waimate in the south to Cheviot in the north and include the micro-climates of Banks Peninsula and Waipara Valley.[6]

Canterbury is the fourth largest wine region after Marlborough, Hawkes Bay and Otago in New Zealand. Table 3.16 shows that in 2019, the region had 68 wineries which is 9 per cent of the total New Zealand wineries. In the same year, there were 13 grape growers in the region which is 2 per cent of the national figure. In 2019, a total area of 1,383 hectares of the Canterbury Region was used for viticulture. The current production area in New Zealand is 38,650 hectares. The most widely planted grapes in Canterbury are Pinot Noir, Chardonnay and Riesling.

[6] See New Zealand Winegrowers (2020).

**Table 3.16 Vineyard Production, Canterbury and New Zealand, 2010–2019**

| | | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Wineries** | **Canterbury** | 61 | 66 | 68 | 70 | 66 |
| | **New Zealand** | 672 | 697 | 703 | 698 | 699 |
| **Grape growers** | **Canterbury** | 60 | 13 | 8 | 14 | 15 |
| | **New Zealand** | 1,128 | 853 | 824 | 835 | 858 |
| **Hectares** | **Canterbury** | 1,779 | 1,809 | 1,371 | 1,435 | 1,488 |
| | **New Zealand** | 33,200 | 34,500 | 35,337 | 35,182 | 35,510 |
| | | **2015** | **2016** | **2017** | **2018** | **2019** |
| **Wineries** | **Canterbury** | 67 | 64 | 65 | 67 | 68 |
| | **New Zealand** | 673 | 675 | 677 | 697 | 716 |
| **Grape growers** | **Canterbury** | 18 | 14 | 14 | 9 | 13 |
| | **New Zealand** | 762 | 747 | 726 | 699 | 692 |
| **Hectares** | **Canterbury** | 1,428 | 1,419 | 1,472 | 1,475 | 1,383 |
| | **New Zealand** | 35,463 | 3,622 | 36,943 | 38,073 | 38,650* |

*Note*: * Estimated.

*Source*: Statistics New Zealand (2018).

# Chapter 4

# Creating Additional Value from Food and Fibre

## 4.1 Introduction

The Primary Sector Council recently offered a vison of New Zealand's food and fibre sector as providing the world's most discerning consumers with outstanding, ethically produced food, natural fibres, drinks, co-products and bio-products, all sourced from our land and oceans.[7] It is possible to create additional value through new products, but also through increasing returns from current production based on differentiating New Zealand sourced products in targeted market segments. There are marketing opportunities and challenges in communicating the quality of New Zealand food and fibre, including their credence attributes discussed in section 4.2 below. Significant change in the Food and Fibre sector is already taking place, led by industry initiatives and supported by public sector programmes.[8] This is not a cause for complacency, however, given the range and scale of challenges facing the sector, but it does mean that a vision for ongoing transformation can build on initiatives already taking place.

An outstanding example of a trans-sector movement promoting a vision for transformation is Te Hono, which is a business-led, government enabled, collection of more than 260 influential leaders in the New Zealand primary sector. Its Directorate is based in Canterbury. The Te Hono vision is that New Zealand's primary sector should be "the global primary industry exemplar – economically, environmentally and socially". Its mission is to enable New Zealand primary industry companies to transform from volume to value; that is, "from commodity sales and traditional agribusiness practices to global producers of high value, consumer-centric products and services".[9]

## 4.2 Credence Attributes

Credence attributes are those product qualities that cannot be immediately seen or experienced in relation to the product, and so rely on consumer trust, supplier communication or independent verification.[10] Examples of credence attributes include food safety, environmental stewardship, animal welfare, social responsibility, cultural authenticity, fair trade, functional foods, organic production, GM-free, water footprint, biodiversity and local foods.[11] Sellers typically make claims about the credence attributes of their products on labels, perhaps reinforced by developing brands or trademarks that are trusted by consumers as assurance that claims are authentic.

[7] See https://fitforabetterworld.org.nz/our-vision/.

[8] See Dalziel *et al*. (2019).

[9] See https://www.tehono.co.nz/our-story. Other relevant material can be seen in Brakenridge (2016), MPI (2017, p. 16) and Proudfoot (2018).

[10] See Wirth *et al*. (2011).

[11] See Saunders *et al*. (2016b, p. 18).

New Zealand produce has many of these credence attributes and there is evidence that consumers are willing to pay a premium for these. For example, New Zealand has a reputation for safe food. The following section outlines some of the research undertaken by the AERU, which shows the level of these premiums by market and product.

This section reviews some of the literature regarding consumer willingness-to-pay (WTP) for certain credence attributes. This draws upon previous large-scale literature reviews produced by the Agribusiness and Economics Research Unit.[12] This is followed by a summary of key results from recent research programme funded by the Ministry of Business, Innovation and Employment (MBIE) and by the Our Land and Water (OLW) National Science Challenge.[13] Food safety is a key credence attribute across all markets, including positive WTP that can be high in some cases (e.g. food safety credentials on food products in China). This is understandable due to widespread public concerns regarding previous food safety incidents around the world. This is also related to traceability, authentication and the importance of trusted certification.

Product quality is an important judgement made by consumer when assessing value for money. Examples of this include the freshness of milk products or tenderness of steak products. Product quality can also be associated with the Country of Origin (COO) where a common finding is that people prefer domestically-produced over imported food products, but some countries are preferred over others.

There is a range of studies that consider the WTP for particular production methods, typically comparing organic, genetically modified (GM) and conventional production practices. Regarding GM production, evidence is mixed, while WTP for organic production (for dairy, fruit and vegetable, wine, oil and flour products) is consistently found to be positive. It has also been shown that consumers often associate organic foods with a range of benefits, such as increased healthiness and limited use of pesticides. There are also market segments that are willing to pay for certain production methods, including grass-fed, as well as various methods regarding agrichemical and animal health product use (e.g. pesticide-free, antibiotic-free).

Similarly, functional foods (i.e. food products that offer health benefits beyond basic nutrition) have also shown to have a positive WTP. In many countries, for example, there is growing interest in these types of products, such as those intended to enhance the immune system, supplement basic nutrition or assist with aspects of beauty, among other effects. Miller *et al*. (2014) includes empirical examples relating to oil, bread, eggs and wine products. In addition, Guenther *et al*. (2017) found that Australian, Chinese and Japanese consumers placed high importance on food products for immune system health, followed by bone/joint health and memory/brain function, with the health of babies and children rated similarly highly.

Consumers are also concerned with environmental or animal welfare issues, particularly in relation to the ethical dimensions of production. For example, studies indicate that consumers in the UK, China

[12] See, for example, Miller *et al*. (2014), Saunders *et al*. (2016b) and Driver *et al*. (2017 and 2019).

[13] See Driver *et al*. (2015), Guenther *et al*. (2015), Saunders *et al*. (2015), McIntyre *et al*. (2018 and 2019), Tait *et al*., (2018a, 2018b, 2018c and 2018d) Dalziel *et al*. (2019), Mayes *et al*. (2019), Rout and Reid (2019) and Saunders *et al*. (2017).

and India are willing to pay for reduced water pollution, reduced greenhouse gas (GHG) emissions and improved biodiversity in agricultural production.[14] Likewise, research has indicated that many consumers are concerned about the health and welfare of animals, potentially influencing their purchase decisions, and are willing to pay a premium. The CE studies have included general animal welfare or free range attributes alongside other types of attributes related to animal health and welfare.

## 4.3 International Consumer Willingness-to-Pay

In 2012, the Agribusiness and Economics Research Unit (AERU) initiated research to explore how international consumers of agri-food products interpret and value credence attribute claims of their purchases. This began with pilot surveys of consumers in India, China and the United Kingdom (UK), which found that consumers in China and India reported a higher value for the credence attributes (especially environmental quality and animal welfare) of food and beverages than in the UK. This was followed by a choice experiment survey to estimate how much consumers would be willing to pay for these credence attributes.

The results showed consumers were willing to pay a range of premiums for agri-food products (dairy and lamb products) with particular credence attributes. As shown in Table 4.1 below, Chinese and Indian consumers were willing to pay large additional premiums for food safety, farm animal welfare, water pollution minimisation, greenhouse gas minimisation, biodiversity enhancement and New Zealand country-of-origin attributes relative to their UK counterparts.

**Table 4.1 Food Attribute Willingness-to-pay (WTP) as a Percentage of Product Price in China, India and the United Kingdom – Dairy and Lamb Products, 2012**

| | China | | India | | United Kingdom | |
|---|---|---|---|---|---|---|
| | *Dairy* | *Lamb* | *Dairy* | *Lamb* | *Dairy* | *Lamb* |
| Food safety | 74% | 44% | 73% | 77% | 16% | 18% |
| Farm animal welfare | 26% | 13% | 42% | 41% | 17% | 22% |
| Water pollution minimisation | 16% | 12% | 19% | 26% | 3% | 7% |
| Greenhouse gas minimisation | 25% | 14% | 38% | 39% | 7% | 7% |
| Biodiversity enhancement | 22% | 15% | 27% | 42% | 6% | 6% |
| Foreign country-of-origin | 26% | 10% | -20% | - | -4% | -5% |
| New Zealand country-of-origin | 49% | 24% | 10% | 21% | 3% | 6% |

*Source*: Saunders *et al*. (2013).

[14] See Saunders *et al*. (2013).

That research was followed by an MBIE-funded programme called *Maximising Export Returns*, active from 1 October 2013 to 30 September 2016. This comprised original research in five important markets for New Zealand agri-food exports: China, India, Indonesia, Japan and the United Kingdom. This was extended with a study of New Zealand consumers using the same methodology.[15]

All results from the programme were published in six research reports, which can be accessed for download without charge at www.lincoln.ac.nz/aeru/mer.[16] Quantitative data from the surveys can be accessed through an on-line data portal using a dashboard platform developed by Dapresy on the website at https://www.sustainablewellbeing.nz/data-portal/.

**Table 4.2 Consumer Willingness-to-pay for Certified Improvement in Production Standards above Minimum as a Percentage of Average Product Price, 2015**

| | India | Indonesia | Japan | United Kingdom |
|---|---|---|---|---|
| **Fruit and Vegetables** | | | | |
| Biodiversity | 44% | 22% | 22% | 18% |
| Environmental condition | 25% | 11% | 5% | 4% |
| Food safety | 27% | 23% | 4% | 5% |
| Health benefits | - | - | - | 16% |
| Product quality | 22% | 18% | - | 22% |
| Social responsibility | 41% | 23% | 14% | 13% |
| **Dairy Products** | | | | |
| Animal welfare | 40% | 29% | 39% | 21% |
| Environmental condition | 18% | 27% | 7% | 14% |
| Food safety | 40% | 27% | 8% | 6% |
| Health benefits | - | 19% | - | - |
| Product quality | 44% | 31% | 17% | 14% |
| Social responsibility | 52% | 27% | - | 6% |
| **Meat Products** | | | | |
| Animal welfare | 36% | 27% | 24% | 12% |
| Environmental condition | - | 16% | 9% | 9% |
| Food safety | 41% | 25% | - | 4% |
| Health benefits | 19% | 25% | - | 6% |
| Product quality | 33% | 17% | 13% | 11% |
| Social responsibility | 38% | 18% | 7% | 9% |

*Note*: Median willingness-to-pay (WTP) reported. Blank cells where no WTP estimate provided indicate insignificant parameter in relevant model.

*Source*: Agribusiness and Economics Research Unit and Miller *et al*. (2017).

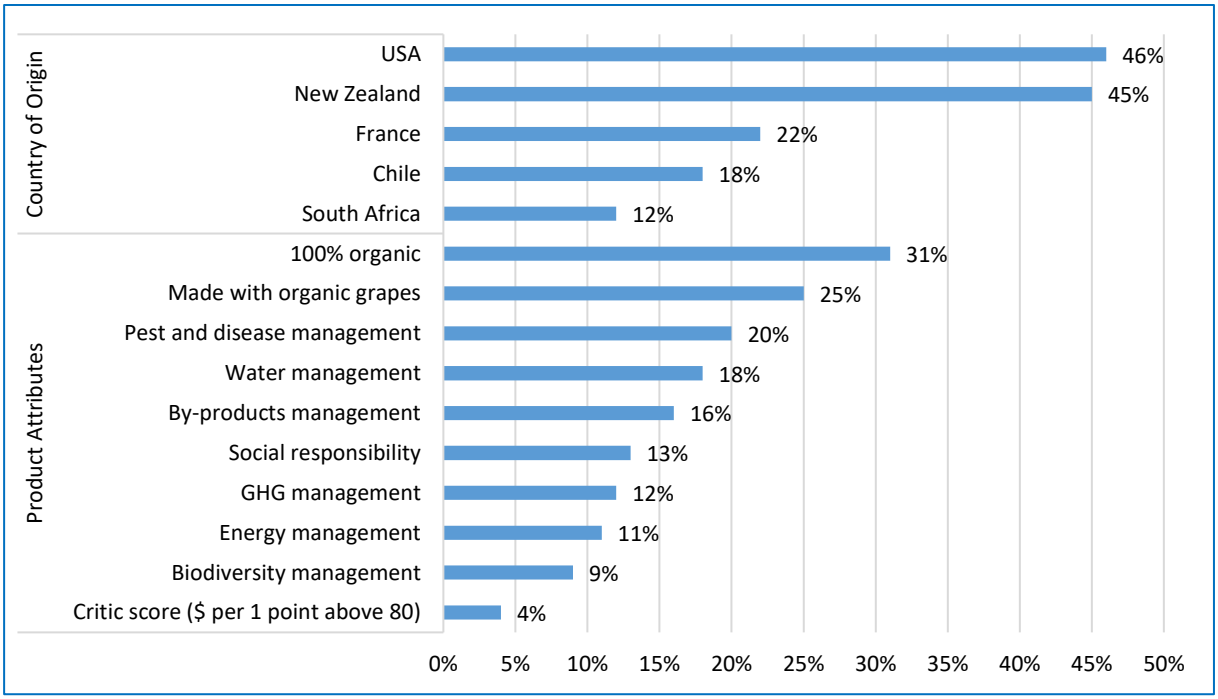
[15] See Miller *et al*. (2016b).

[16] The six reports were: Miller *et al*. (2014); Lees and Saunders (2015); Saunders *et al*. (2015a); Guenther *et al*. (2015); Driver *et al*. (2015); and Saunders and Driver (2016).

Consumer surveys were undertaken in China, India, Indonesia, Japan and the United Kingdom between March and April 2015. The surveys included choice experiments (CE) designed to elicit these consumers' willingness-to-pay (WTP) for the credence attributes of different food products, including dairy, fruit and vegetable, meat, and wine products. These results are shown in Table 4.2 above. Similarly to the preceding 2012 study, these results indicated that consumers in developing countries were willing to pay much higher premiums for the inclusion of credence attributes in food products relative to their developed country counterparts. These attributes included animal welfare, environmental condition, food safety, human health enhancement, product quality and social responsibility.

Further research funded by the OLW National Science Challenge involved choice experiments in four key markets: wine and beef in California; and kiwifruit and yoghurt in Shanghai.[17] This research provides further evidence that consumers are willing to pay a premium for certain credence attributes, and New Zealand does enjoy a high reputation in these specific markets. The research also provided further insights into consumer awareness of New Zealand food and beverage products, as well as consumer attitudes towards use of modern technologies for obtaining information about food and beverage purchases.

**Figure 4.1 Consumer Willingness-to-pay for Attributes of New Zealand Sauvignon Blanc as a Percentage of Average Bottle Price, California, 2017**



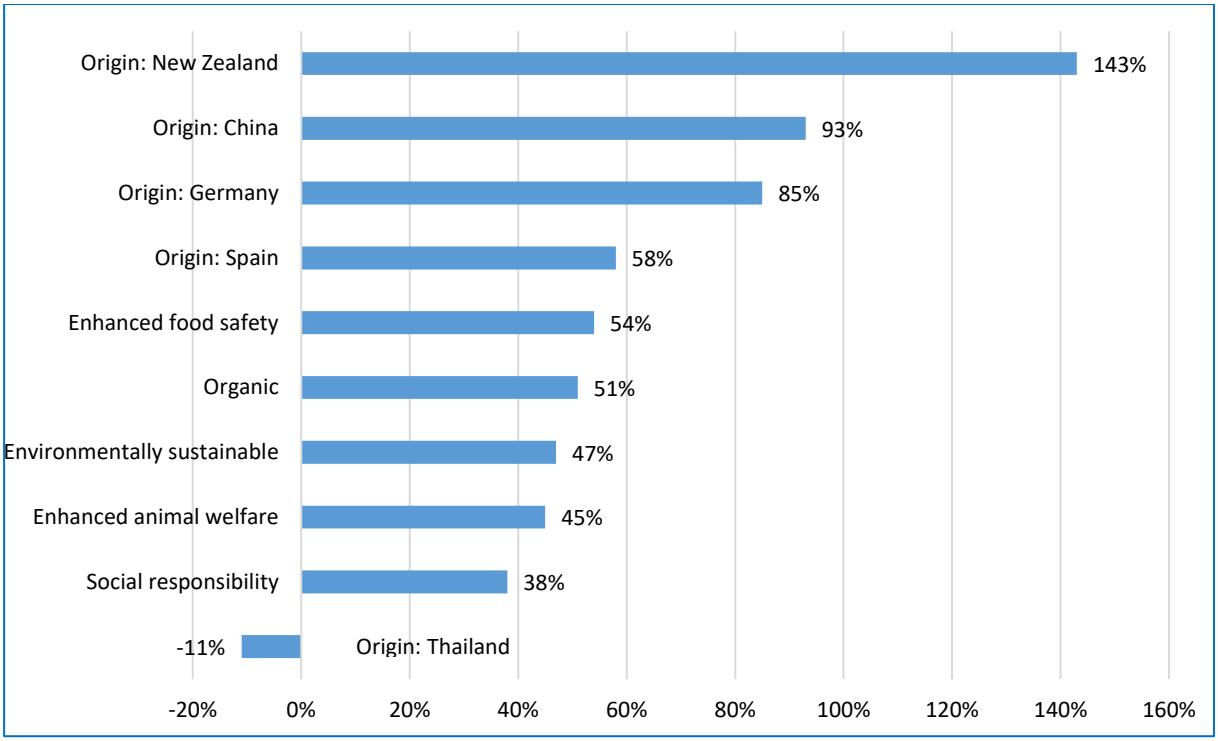

*Source*: Tait *et al*. (2018d, derived from Table 4.2).

[17] Tait *et al*. (2018a, 2018b, 2018c and 2018d). Survey data can also be accessed at the AERU data portal at https://www.sustainablewellbeing.nz/data-portal/.

Figure 4.1 on the previous page is an example from that research. Sauvignon blanc consumers in California revealed they were willing to pay a premium of over 30 per cent for 100% organic wine and 25% for wine made with organic grapes, but similar premiums were found for pest and disease management, for water management and for by-products management. The study also found that Californian consumers were willing to pay a premium for wine produced in the United States (a preference for home country of origin is common in the literature.[18] Nevertheless, New Zealand Sauvignon blanc enjoys a comparable premium, considerably higher than for Sauvignon blanc produced in Chile, France or South Africa.

Similar results were obtained throughout the research programme. As shown in Figures 4.2 to 4.4 below, yoghurt and kiwifruit consumers in Shanghai and beef consumers in California are willing to pay a premium for products of New Zealand origin, as well as for a number of credence attributes.

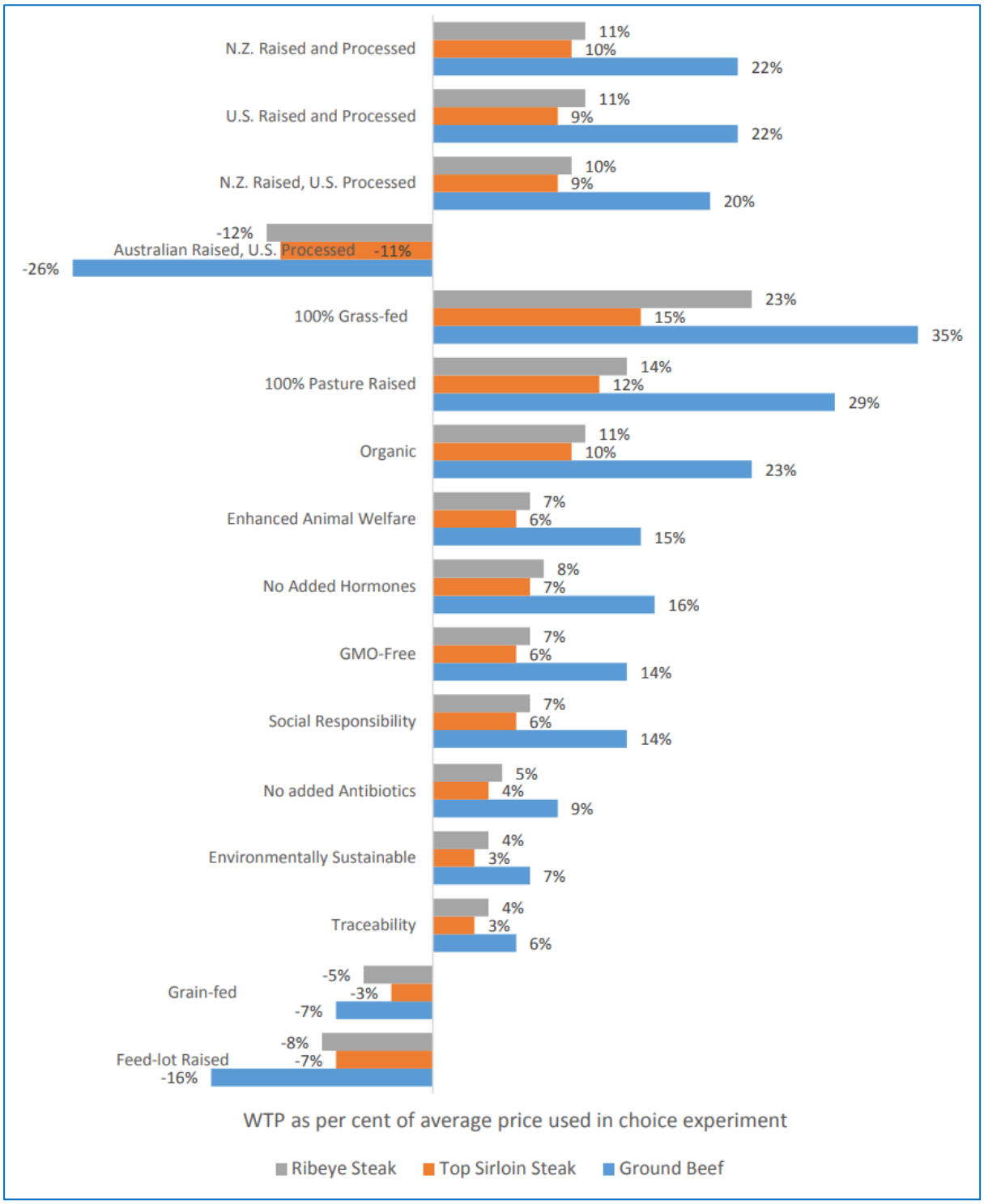
**Figure 4.2 Consumer Willingness-to-pay for Attributes of New Zealand Yoghurt Products as a Percentage of Average Product Price, Shanghai, 2017**




*Source*: Tait *et al*. (2018b, derived from Table 4.2).

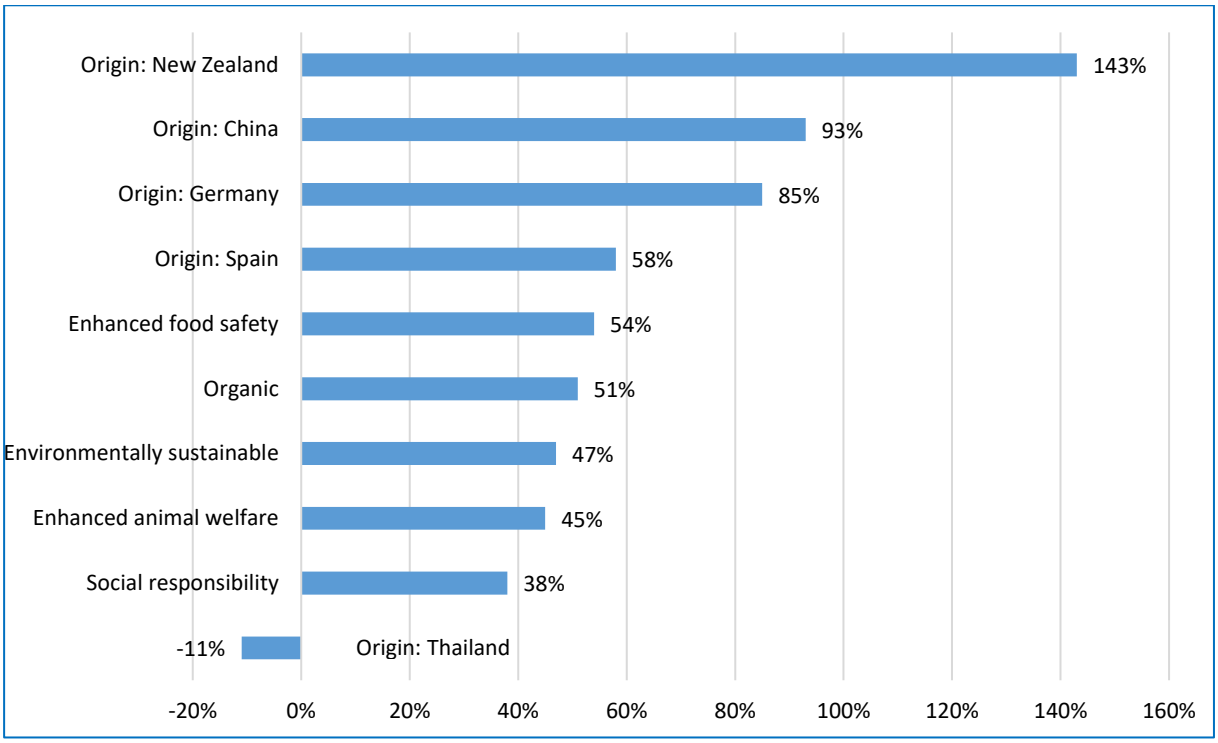
[18] See, for example, Miller *et al*. (2014, p. 94).

**Figure 4.3 Consumer Willingness-to-pay for Attributes of New Zealand Beef Products as a Percentage of Average Product Price, California, 2017**




*Source*: Tait *et al*. (2018c, Figure 4-5).

**Figure 4.4 Consumer Willingness-to-pay for Attributes of New Zealand Kiwifruit as a Percentage of Average Product Price, Shanghai, 2017**




*Source*: Tait *et al*. (2018a, derived from Table 4.2).

Research examining consumer preferences and willingness-to-pay for attributes of New Zealand food products is currently being carried out under the Unlocking Export Prosperity (UEP) programme, funded by MBIE from 1 October 2017 to 30 September 2022. This includes surveys examining consumer preferences for specific products in key markets for New Zealand's food and fibre exports, specifically:

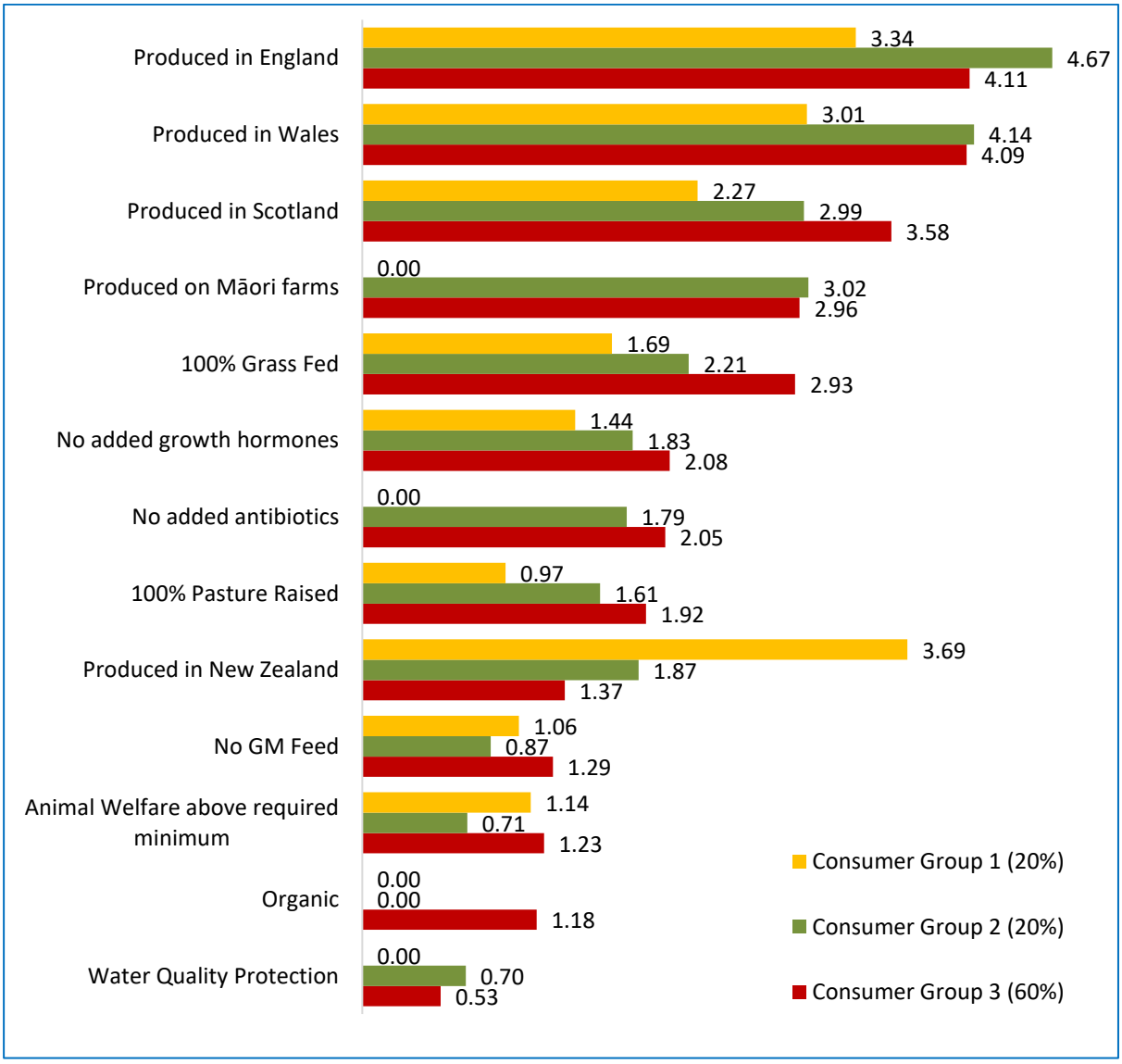
- China (Beef, Dairy)
- Japan (Kiwifruit)
- United Arab Emirates (Beef)
- United Kingdom (Lamb, Alternative Proteins)[19]
- United States of America (Apples, Sauvignon blanc wine)

This programme is ongoing, with some preliminary results available. For lamb consumers in the United Kingdom, for example, consumers' willingness-to-pay for a range of New Zealand lamb attributes were estimated – these results are shown in Figures 4.5 and 4.6 below. A feature of this study is that it aims to analyse different market segments within the country by using statistical methods to identify three groups of consumers that share similar characteristics, based on their answers to questions in the survey. Figures 4.5 and 4.6 show the results for the three groups separately.

[19] The COVID-19 crisis means the full Alternative Proteins survey may be delayed.

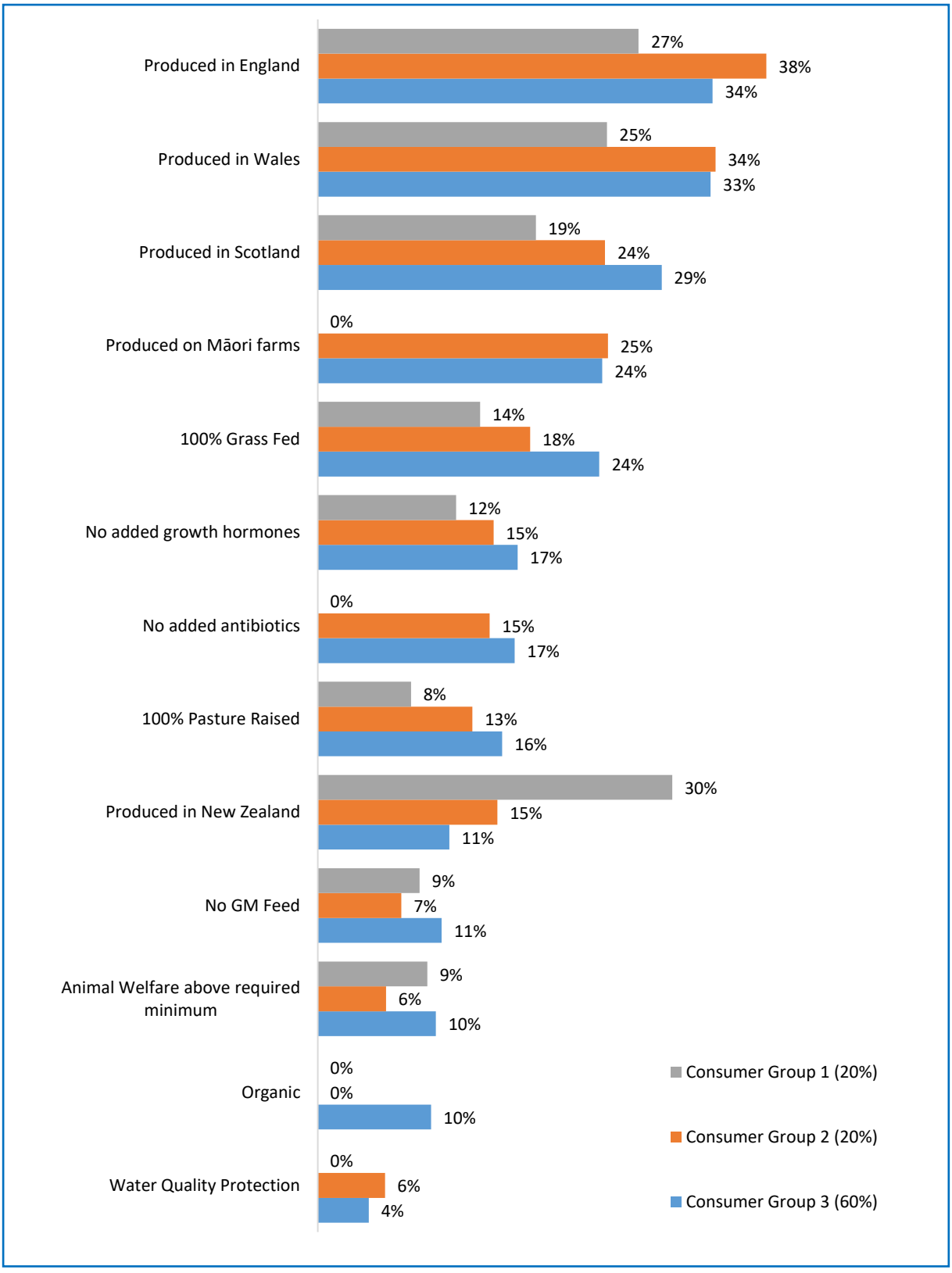
That analysis is ongoing, including more details on the characteristics of the three groups. The results will be made public later this year. For this report, the analysis reveals a range of premiums associated with specific lamb product attributes. Overall, the results show a particular preference for domestic lamb, with an emerging consumer segment willing to pay a higher relative premium for lamb products of New Zealand origin. Interestingly, Consumer Group 1 revealed a considerably higher premium for New Zealand lamb than the other two groups. This was in contrast to their generally lower willingness-to-pay for other attributes. This indicates the potential for greater rewards if New Zealand exporters can target specific market segments in each country.

**Figure 4.5 Consumer Willingness-to-pay for Attributes of New Zealand Lamb above Average Product Price, £/kg, United Kingdom, 2019**




*Note*: Average price is the average of prices used in the choice experiment.

**Figure 4.6 Consumer Willingness-to-pay for Attributes of New Zealand Lamb as a Percentage of Average Product Price, United Kingdom, 2019**

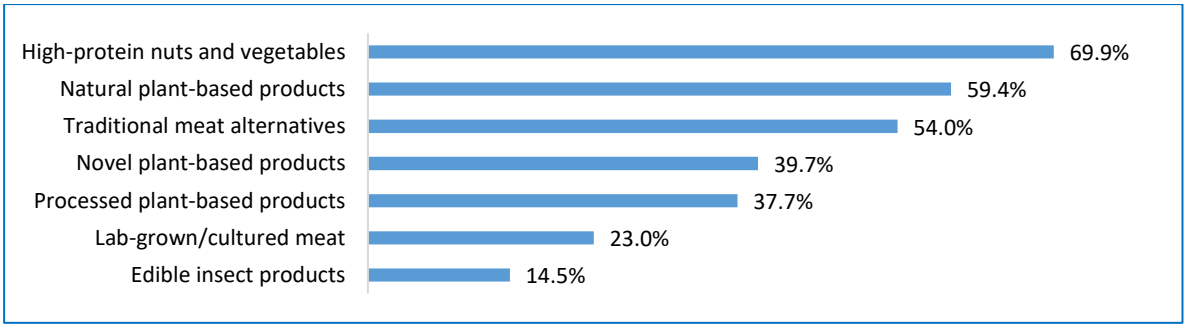



*Note*: Average price is the average of prices used in the choice experiment.

A pilot survey has provided preliminary results on United Kingdom consumer attitudes towards, and preferences for, alternative protein products. The survey asked participants to consider their consumption of alternative protein products, including their current willingness to consume particular alternative protein products, the importance of alternative protein attributes, and factors that would motivate them to regularly consume a larger or smaller amount of these products. Results are shown in Figures 4.7 to 4.10 below.

Participants were asked to indicate if they would consume a higher amount of particular alternative protein products. Results, as depicted in Figure 4.7 below, show that UK consumers were generally more willing to consider consuming a higher amount of more natural, unprocessed alternative protein products. Consumers showed a particular aversion to more processed products such as novel and processed plant-based products (39.7 and 37.7 per cent *yes* respectively), lab-grown/cultured meat (23 per cent *yes*) and edible insect products (14.5 per cent *yes*).

**Figure 4.7 Consumer Willingness to Consider Consuming a Higher Amount of Alternative Protein Products, Percentage Responding 'yes', United Kingdom, 2019**




Participants were also asked to indicate which attributes of alternative protein products were important to them when shopping for food. As shown in Figure 4.8 below, participants found the attributes of *taste* and *price* to be most important (93.1 and 84.4 per cent *very important* and *important* respectively), followed by *animal welfare* (79 per cent *very important and important*) and attributes relating to the 'naturalness' of the products – *natural ingredients*, *no additives* and *level of processing* (77.3, 69.4 and 66.1 per cent *very important* and *important* respectively).

Participants were then asked to indicate which factors would motivate them to consume a higher amount of alternative protein products. As shown in Figure 4.9 below, these factors were *taste* (88.1 per cent *very important* and *important*), followed by *to improve health* (76 per cent *very important* and *important*) and *as part of a balanced diet* (70 per cent *very important* and *important*), closely followed by *animal welfare concerns* (68.3 per cent *very important* and *important*).

Similarly, participants were asked to indicate which factors would be most important in dissuading them from consuming alternative protein products. As shown in Figure 4.10 below, these factors were expensive products (70.2 per cent very important and important), health concerns (68.7 per cent very important and important) and a general preference for meat products (67.1 per cent very important and important).

**Figure 4.8 Importance of Selected Attributes of Alternative Protein Products when Shopping for Food, Percentage Responding 'Very Important' and 'Important', United Kingdom, 2019**

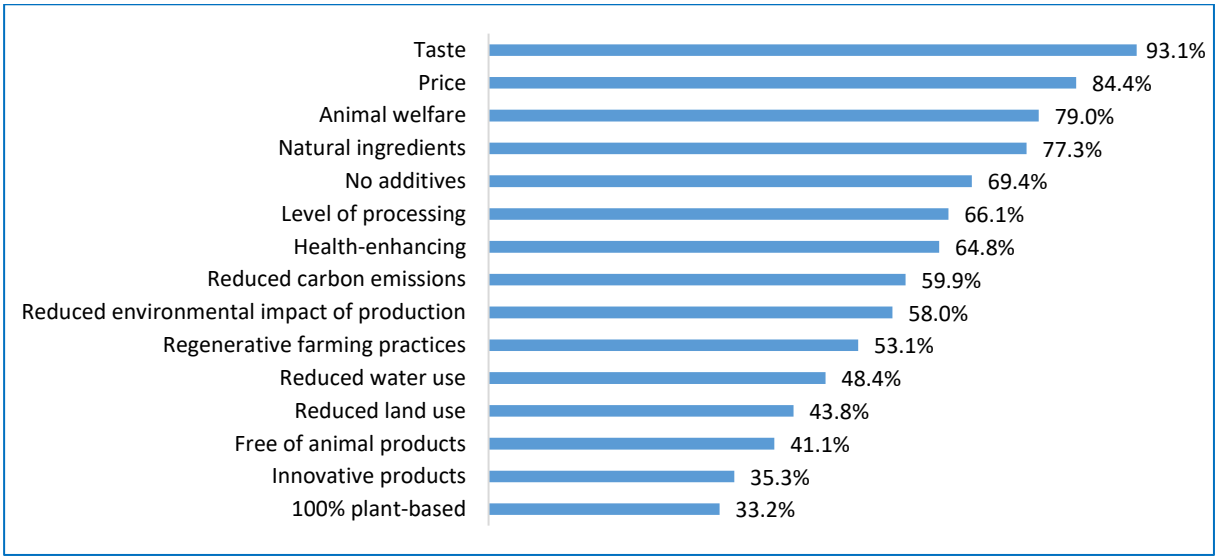



**Figure 4.9 Importance of Factors in Motivating Consumption of Alternative Protein Products, Percentage Responding 'Very Important' and 'Important', United Kingdom, 2019**

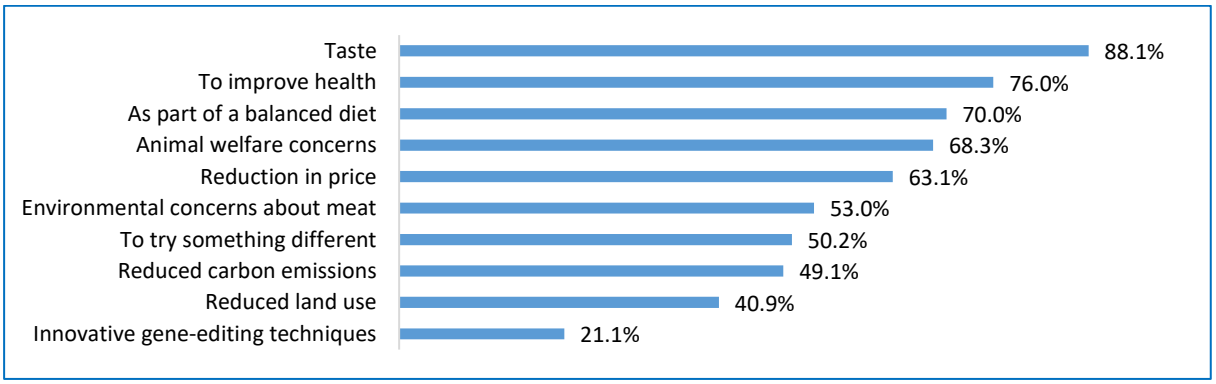



**Figure 4.10 Importance of Factors in Dissuading Consumption of Alternative Protein Products, Percentage Responding 'Very Important' and 'Important', United Kingdom, 2019**

## 4.4 The New Zealand and Canterbury Stories

A key factor that may contribute to consumer trust is the country-of-origin of the food or beverage being purchased. Indeed, country-of-origin labelling (COOL) is mandatory for at least some food products in the major countries importing from New Zealand such as the United States, China, the European Union and Australia.[20] A number of studies have observed that COOL can support product differentiation and so create a competitive advantage that is not easily copied.[21] In particular, country-of-origin may be used by consumers as a cue for judging attributes such as quality and food safety.[22]

Futurebrand (2014, p. 30) notes that "brand-driven consumption is increasing exponentially worldwide with the explosion of new middle class consumers in the BRIC markets (Brazil, Russia, India, China) and other developing nations", so that "it is arguable that Country of Origin brands will start to contribute significantly to national reputation and overall country brand strength".

Consistent with that insight, the New Zealand Government launched an initiative in 2013 to help develop New Zealand's International marketing brand, called the New Zealand Story.[23] Its purpose is to enhance New Zealand's reputation by helping exporters tell a broad, compelling and aspirational story about New Zealand, grounded in three values:[24]

> **Kaitiaki**
> Care of people and place (our role as guardians). We are guardians of people, place and planet. This care extends to everything we do and everything we create. We are considered a progressive nation yet we seek not to damage what is precious.
>
> **Integrity**
> From a good place (our foundation). We do what we say we will do, and we do the right thing, because it's the right thing to do. This deeply ingrained value delivers the trust behind our good reputation.
>
> **Ingenuity**
> Challenging the status quo with original and bold solutions. With our spirit of exploration, adventure and creativity, we turn ideas into reality and solve what others do not. Our fresh perspective to problem-solving and making things happen is valued by others.

Initiatives such as the New Zealand Story are important because countries are competing for leadership in this space. Origin Green, for example, was created by the Irish Food Board. It describes itself as "Ireland's food and drink sustainability programme" and has promoted itself as "the only sustainability programme in the world that operates on a national scale, uniting government, the private sector and food producers".[25]

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[20] See Miller *et al*. (2016a).

[21] See, for example, Carter *et al*. (2006), Baker and Ballington (2002) and FutureBrand (2014 and 2015).

[22] See, for example, Claret *et al*. (2012), Berry *et al*. (2015), Insch *et al*. (2015), Cicia *et al*. (2011), Lim *et al*. (2014), Ortega *et al*. (2014) and Lewis and Grebitus (2016).

[23] https://www.nzstory.govt.nz/.

[24] Quote is from https://www.nzstory.govt.nz/about-us/our-story/.

[25] See https://www.origingreen.ie/ and Irish Food Board (2017).

Canterbury also has a proud story to tell about its history of food and fibre production. Canterbury branded lamb is one of the oldest brands in New Zealand. Peden (2012), for example, observes that "in 1895 it was noted in newspapers that 'Canterbury' had become the standard term for the best class of meat exported from New Zealand, regardless of its actual place of origin". Hawke (1985, p. 85) similarly notes that efforts had to be made "preventing interlopers from using the band name of 'Canterbury'". It remains a valued marketing term to the present day (ANZCO, 2015):

> There's no prouder province in New Zealand than Canterbury, and it's not just down to the beauty of its snow-clad peaks, lakes and majestic rivers. Canterbury has long been one of the great beef and lamb producing regions in this country, thanks to its unique mix of nature's gifts and smart farming.

## 4.5 Global Agri-food Value Chains

The previous sections have presented evidence that consumers are willing to pay for quality products that have strong credence attributes. However, this will not benefit New Zealand producers if the products are sold as standard commodities in a supply chain. Traditionally, the food and fibre sector in New Zealand has been very successful at producing commodities, creating supply chains that are effective and safe.

The focus of the supply chain has been to push product from the farmer to the market as efficiently as possible to satisfy demand schedules, while simultaneously achieving consistent quality and economies of scale through high volume production. Over time, these chains have begun to be criticised for being supply-driven and ignoring the voice of the customer, which leads to wrongly specified products and extra costs across the chain.[26] Hence, there has been a shift in viewing agribusiness production as commodity producing supply chains, to value-added, differentiated value chains.

The concept of value chains was popularised by Michael Porter (1985) to describe a firm's internal value-adding activities. Each firm along the chain becomes a vehicle for value-added production where value is sequentially added, and generic strategies such as low cost production and product differentiation are suggested as a way to provide a competitive advantage in the market place. The concept has since been extended outside the internal firm, and is informally described as 'farm gate to plate' or 'beef to burger'. Thus, Kaplinsky (2000, p. 121) defines the VC as:

> … the full range of activities which are requires to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and the final disposal after use.

Indeed, the way competition is viewed has shifted from individual firms competing against each other, to chains competing against chains. Hence, the entire chain becomes a "vehicle for adding value and eliminating waste". This paradigm shift facilitates coordination and collaboration among actors in the chain to deliver products that meet the needs of the consumer in an efficient and effective manner.[27]

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[26] See, for example, Grunert *et al*. (2005).

[27] Some key references are: Fearne *et al*. (2012); Spekman *et al*. (1998); Brinkmann *et al*. (2011); and Spekman *et al*. (1998). The quote comes from Sausman *et al*. (2015, p. 199).

This shift implies that firms within value chains must adopt a market orientation, which means focusing on communicating with consumers in order to understand their needs and then disseminating this information across the chain in order to make decisions about production, value-adding processes, and marketing. When a chain adopts this view it has the ability to develop a competitive advantage and superior long term chain performance.

One of the challenges of the agri-food industry in general, is that chains are not large enough to achieve adequate economies of scale. Consequently, many chain actors find that market demands are not adequately communicated throughout the chain. Additionally, the diversity of production is often times not exploited as effective and efficiently as it could be for serving the end-market.[28]

**Figure 4.11 Using Collaborative and Market Oriented Value Chains to Create Value**

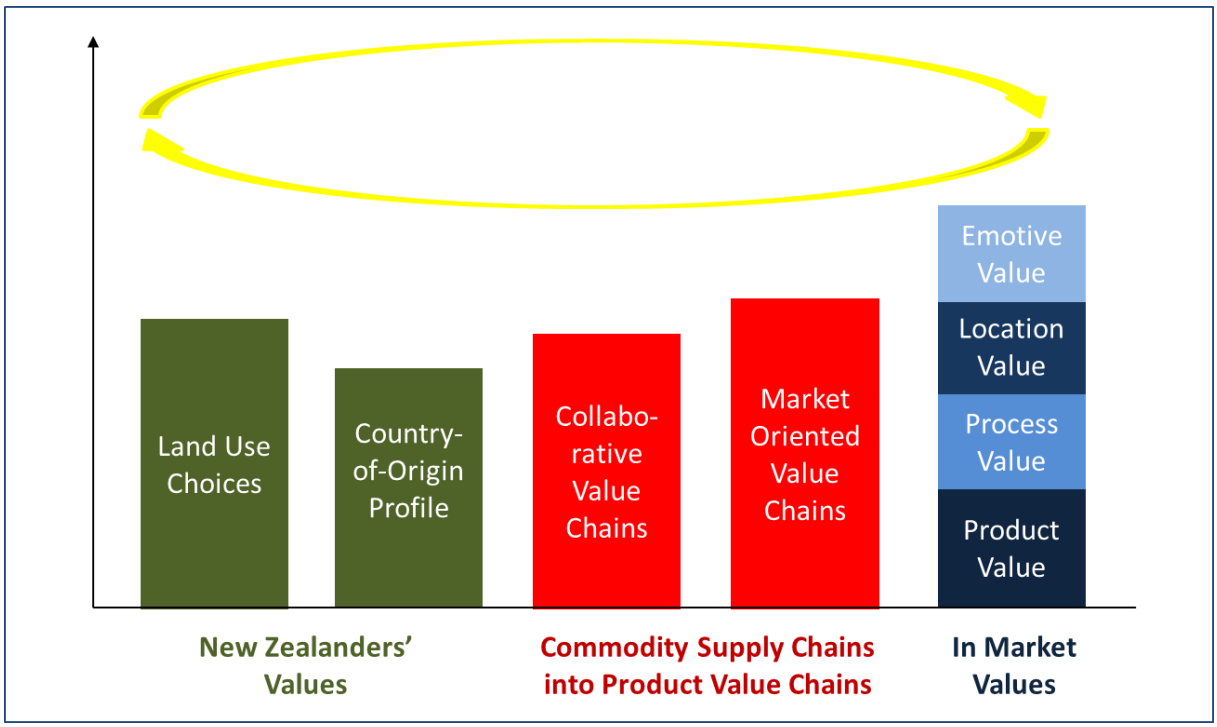



Figure 4.11 presents a model prepared for the Our Land and Water National Science Challenge, illustrating how collaborative and market-oriented value chains can bring together New Zealanders' values with in-market values. The in-market values can be categorised into four sources of value: product value, process value, location value and emotional value.[29]

- ***Product Value***: The traditional sensory properties, such as freshness, taste, texture and flavour, as well as the product's purchase price.

[28] See, for example, Trienekens *et al*. (2012).

[29] This classification comes from Dagevos and van Ophem (2013).

- ***Process Value***: The processes and practices used to produce the food, including their impact on items such as food safety, ecosystem sustainability and animal welfare.
- ***Location Value***: The setting and atmosphere of where the food is consumed or purchased, which might be at home, in a restaurant, from a supermarket or from some other retailer.
- ***Emotional Value***: The emotional response to the consumption experience, including the impact of any 'story' or 'brand' associated with the product.

On the left-hand-side of Figure 4.11 are the land use choices and country-of-origin profile, both of which reflect New Zealanders' values. There is no suggestion that New Zealanders' values should change to meet in-market values; rather, the proposal is that where the two sets of values align, there are opportunities to create and capture value by communicating the value attributes to final consumers. This requires turning commodity supply chains into product value chains.

Creating and capturing value requires communication in both directions along the value chain. Market intelligence about what is valued by final consumers must be gathered and disseminated along the value chain to support customer-focused decisions about production, value-adding processes and marketing. The relevant qualities created by the production, processing and distribution systems in the value chain must be communicated to, and trusted by, final consumers in order for that added value to be captured.

The research by Saunders *et al*. (2016b) drew on a Canadian study by the Value Chain Management Centre (2012) to distinguish four types of value chains: fragmented; cooperative; coordinated; and collaborative. It provided evidence that consumer value is best created and captured in collaborative value chains. These require participating companies to engage in longer-term strategic arrangements for mutually beneficial outcomes. These arrangements require attention to be given to governance of a value chain, which can range from spot/cash market arrangements to full vertical integration.[30]

Research funded by the Our Land and Water (OLW) National Science Challenge in the programme 'Integrating Value Chains' explored several value chain attributes through an examination of five New Zealand based value chain case studies.[31] This research identified key factors that characterised successful value chains. Not surprising, a key finding was that all five value chains had adopted a strong consumer focus, or placed a large emphasis on *manaakitanga* for consumers. Information sharing was found to be critical among chain members and this was largely facilitated by the lead firm in the chain. All chains regarded information as critical.

All value chains highlighted the importance of 'values' as opposed to 'value'. While value is an important driver of chain activities, firms were largely concerned with developing relationships in which trust became an implicit, based upon a foundation of shared values, vision, and culture. The presence of these throughout the chain, in addition to supporting incentives was crucial in ensuring alignment within the value chain – a key to reducing frictions.

[30] See Peterson *et al*. (2001).

[31] See McIntyre *et al*. (2019).

Another key finding was the distinction between leadership and power. Interestingly the leader was often not the most powerful actor in the chain. However, they act as the *kaumātua* in the chain, holding and up keeping the shared values, and engaged in a number of activities to mitigate the power that other actors hold.

Innovation and learning were crucial in ensuring that value chains remain competitive and continue to produce a value-added differentiated product.

Finally, product quality (including taste and credence attributes) was found to be important to the value chains examined, as it was seen as a critical factor in enforcing the brand promise sold to consumers. Certification schemes and quality control programs were undertaken by most of the value chains and communicated to consumers through labelling and the telling of the brand story.

# Chapter 5

# Applying a Wellbeing Framework

## 5.1 Introduction

In May 2018, the New Zealand Government presented to Parliament the world's first Wellbeing Budget. This reflected a global movement towards moving beyond Gross Domestic Product as the dominant measure of economic performance to including a wider focus on broad indicators of wellbeing. The Budget was supported by the New Zealand Treasury's Living Standards Framework (LSF), which in turn drew on a wellbeing conceptual framework produced by the Organisation for Economic Cooperation and Development in Paris.[32] Both the OECD framework and the Treasury's LSF adopt a capitals-based approach to wellbeing. This has a simple meaning. In order to sustain wellbeing into the future, it is essential for a country to invest in maintaining the fundamental assets that people rely on for creating wellbeing.

This chapter applies a wellbeing framework to discuss the health of the fundamental assets underpinning the performance of the Food and Fibre sector in Canterbury. Section 5.2 presents a capital-based framework created by the Agribusiness and Economics Research Unit, which expands the Treasury LSF in some useful ways for an analysis of this type. In particular, it identifies seven different capital types, which expands the Treasury's set of four capital stocks. Section 5.3 then examines each of the seven capitals in the context of the Canterbury Food and Fibre sector. This provides a structure for proposing potential statistical indicators to monitor the long-term health of the sector, which is done in the final chapter.

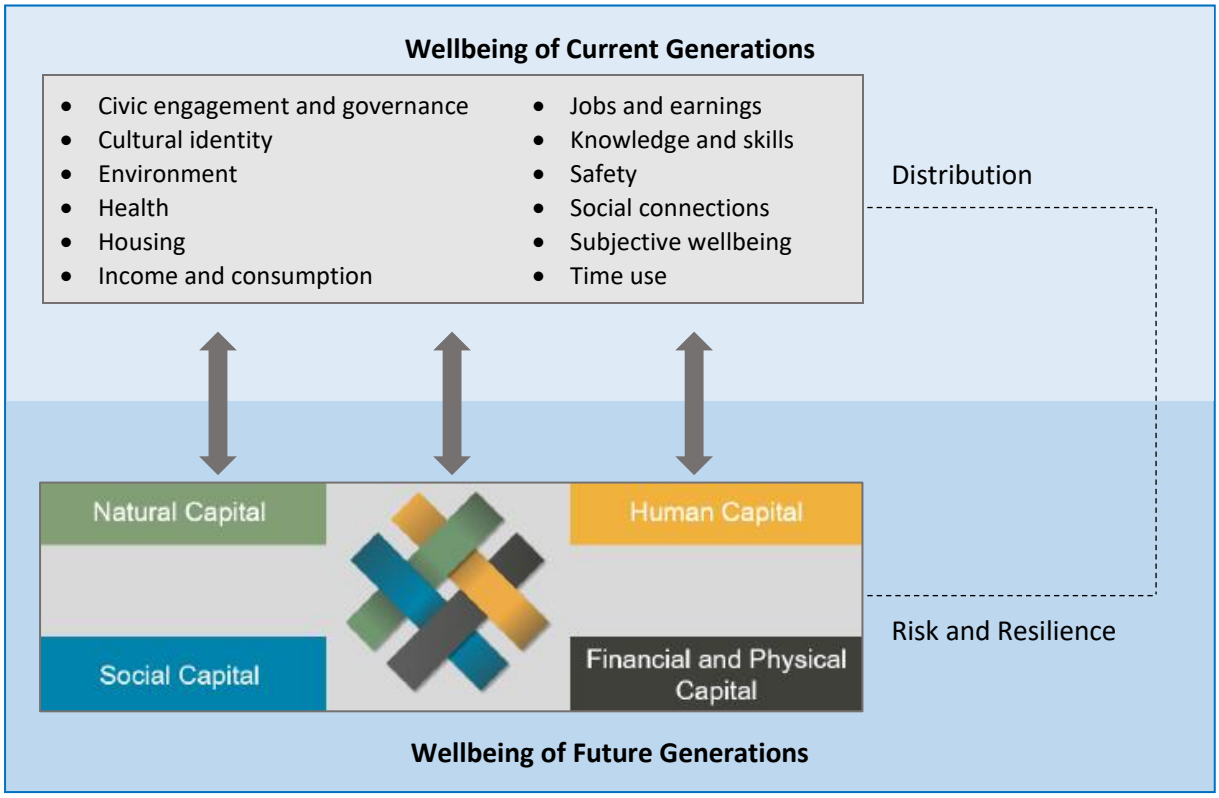
## 5.2 The AERU Wellbeing Framework

Figure 5.1 presents a visual representation of the Treasury's Living Standards Framework. It has two parts. The top section monitors the wellbeing of *current generations* of New Zealanders. It does this by creating 12 wellbeing domains that reflect personal and community wellbeing. Statistical indicators in each domain provide data on trends and distribution among different groups in the population. Thus, distribution is an important cross-cutting theme in the LSF analysis of current wellbeing.

The second part of Figure 5.1 addresses the wellbeing of future generations. The basic idea is that the current generation must bequeath to future generations different types of assets that provide services for people and organisations to use for sustaining wellbeing. Following common international practice, the Treasury focuses on four capitals: natural capital; human capital; social capital; and financial and physical capital. These will be defined shortly, but note that just as 'distribution' is a cross-cutting theme in the analysis of the twelve domains of current wellbeing, 'risk and resilience' make up a cross-cutting theme in the analysis of the four capitals.

[32] See OECD (2017) and Treasury (2018). Dalziel (2019b) argues that there is a distinctive Australasian tradition of wellbeing economics. Dalziel, Saunders and Saunders (2018) provides a detailed examination of wellbeing economics, based on what it calls the capabilities approach to prosperity.

**Figure 5.1 The Treasury's Living Standards Framework**




*Source*: Adapted from Treasury (2018, Figure 1, p. 4).

Figure 5.2 presents an extended version of the LSF, which has been created by the Agribusiness and Economics Research Unit at Lincoln University. Like the LSF, Figure 5.2 places indicators of current wellbeing at the top of the diagram, grouped under the same twelve wellbeing domains developed by the Treasury. Further, the AERU framework similarly places different types of capital stocks at the bottom of the diagram, making up total wealth bequeathed to future generations.

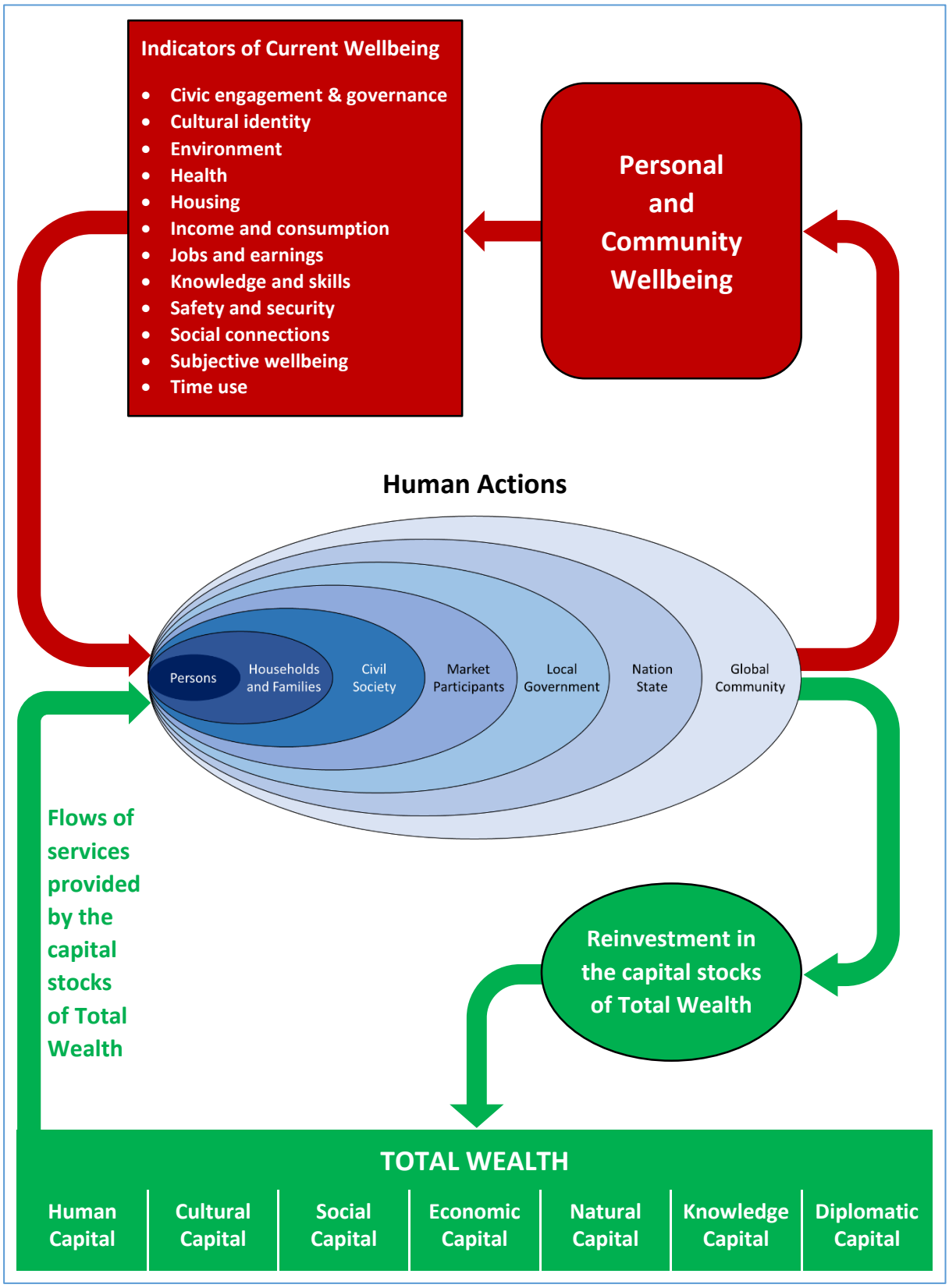
The AERU framework extends the LSF in two aspects.

First, the AERU framework increases the number of capital from four to seven. This includes the LSF capitals, but adds cultural capital, knowledge capital and diplomatic capital:[33] This produces the following list, with definitions.

- ***Human capital***. This refers to the skills and health embodied in an individual person. The skills develop through education and experience. The health depends on, among other things, access to quality medical care.
- ***Cultural capital***. This refers to norms, values and practices that pass down from generation to generation within a cultural group. Each generation transforms its cultural heritage as part of the community's cultural vitality.

[33] Figure 52 gives 'financial and physical capital' the simpler label of 'economic capital'.

**Figure 5.2 The AERU Wellbeing Economics Framework**




*Source*: Dalziel (2019b, Figure 1, p. 480).

- ***Social capital***. This refers to the institutions (such as an independent justice system) and inter-cultural values (such as trust and willingness to collaborate) that bind people together and foster communal initiatives for wellbeing.
- ***Economic capital***. This refers to physical capital (such as buildings, factories, roads, railways, vehicles, plant, machinery and tools) and financial capital (such as debentures, equities, shares, bank deposits and other forms of money savings).
- ***Natural capital***. This refers to the natural environment, particularly in the way that land, water, air and other natural aspects provide ecosystem services needed to support human life and wellbeing.
- ***Knowledge capital***. This refers to the global stock of human knowledge, which expands through scientific enquiry, research and development. Some knowledge is privately owned (intellectual property), but most is accessible by people with the necessary human capital.
- ***Diplomatic capital***. This refers to institutions and shared norms that allow collaboration on a global scale for the common good. A relevant example for this report is the system of global and unilateral trade agreements monitored by the World Trade Organisation.

The second extension in the AERU framework is to incorporate human actions, represented by the seven ovals at the centre of Figure 5.2. This emphasises human agency in creating, sustaining and expanding wellbeing. Agency begins with individual persons making choices (always in relation to other people), but also involves collaboration with an expanding range of other people.

Thus, persons form households and families. People engage in groups, movements and institutions making up civil society. People participate in the market economy, as employers, employees and consumers. Further capabilities for wellbeing result from the activities of local government and the nation state. Some actions to promote wellbeing require collaboration on a global scale.

This creates a dynamic model, reflected in the arrows of Figure 5.2. Thus, the seven capitals making up the country's total wealth provide flows of services to people, who use those services to create wellbeing, measured by the indicators grouped into twelve domains. The level of achieved wellbeing feeds back into people's capabilities for human actions. To be sustainable, some of those actions must include reinvestment in the country's capital stocks, so that future generations are able to sustain or further expand wellbeing.

This framework can be applied to a sector of the market economy, such as the Canterbury Food and Fibre sector. Indeed, it is no accident that market participation is literally at the centre of Figure 5.2. Market institutions, when markets are operating well, are powerful contributors to wellbeing, both for the goods and services they provide to consumers and for the opportunities they create for entrepreneurship and employment.

The framework emphasises that human actions, including the activities of the Canterbury Food and Fibre sector, rely on services provided by the seven capitals. The following section therefore discusses each capital in the context of the Food and Fibre sector.

## 5.3 The Capital Stocks of the Canterbury Food and Fibre Sector

This section considers each type of capital stock in turn. For each capital, there is a definition and brief explanation of its relevance to the Food and Fibre sector, followed by a paragraph on how reinvestment in the capital can be supported. This material is taken from a report prepared by the AERU for the Primary Sector Council in 2018.[34] Each section then discusses the capital stock in the context of the Canterbury Food and Fibre sector.

### *5.3.1 Human Capital*

Human capital refers to an individual person's expanded capabilities for wellbeing as a result of formal education, relevant experience or improved health. In a market context, higher human capital is associated with greater skills that increase a person's labour productivity; that is, an employee with more education, greater experience or better health typically produces a greater value of output per hour or work. This opens up opportunities for higher earnings than available to a person with lower human capital.

The Food and Fibre sector requires people with general and specialist skills working in the private sector and the public sector. The private sector skills range from expertise in different aspects of production in New Zealand's primary sector industries to experience in sophisticated market analysis of different market segments in New Zealand's export destinations around the world. Public sector skills include expertise in designing and implementing biosecurity systems, experience in creating and supervising effective regulatory regimes, and diplomatic skills in negotiating access of New Zealand products into overseas markets.

Individuals choose to invest resources in their human capital by participating in education. These choices can have profound impacts on personal and national wellbeing, so that access to quality careers education and guidance is valuable. It is important that schools and tertiary education institutions offer education that remains relevant to the evolving skill demands of industry, influenced by new technological and commercial opportunities. The rapid change occurring in some technologies means that life-long education and retraining is required to maintain a skilled workforce for industries competing in international markets.

Canterbury is fortunate in having New Zealand's specialist land-based University located at Lincoln. Lincoln University provides graduates with advanced skills relevant to all parts of the Food and Fibre sector (including agriculture, life sciences, environment, society, design, agribusiness and commerce). Nevertheless, New Zealand Immigration's Regional Skill Shortage List dated 27 May 2019 includes seven occupations within the Agriculture and Forestry group: apiarist; arborist; beef or dairy cattle farm manager; dairy cattle assistant farm manager; market garden agronomist manager; pig farm manager or assistant farm manager; and winemaker or viticulturist. Nationally, the agriculture, forestry, and fishing industry had the highest work-related ACC claim rate at 190 claims per 1,000 FTEs (10.5 percent of all claims).[35]

[34] See the Appendix to Dalziel *et al*. (2018b).

[35] https://www.stats.govt.nz/information-releases/injury-statistics-work-related-claims-2018.

### *5.3.2 Cultural Capital*

The key idea behind the metaphor of cultural capital is that a young person growing up in their extended family context inherits from previous generations diverse cultural values and norms for practising those values. Those values and norms can be called cultural capital, helping people to develop a sense of place in their communities, in the natural environment and in the nation. As the Ministry of Culture and Heritage observes on its website, "cultural expression is central to a vibrant, healthy society [and] also reflects and reinforces what it means to be a New Zealander, helping to build connection and cohesion". Cultural capital defined in this way is never set in stone; each new generation transforms the cultural heritage it has received as part of the community's cultural vitality.

The New Zealand Food and Fibre sector is imbued with cultural norms and values. Family farms have been a feature of the sector since the nineteenth century. Iwi, hapū and whānau are significant producers of food and fibre, operating with strong cultural values of association with land and water. The Resource Management Act requires all persons under the Act to have particular regard to cultural norms such as kaitiakitanga, stewardship, efficiency, maintenance of amenity values and respect for intrinsic values of ecosystems. Cultural norms of collaboration and being good neighbours can be found everywhere in rural regions and towns throughout New Zealand.

Just under two-thirds of New Zealanders live in urban areas, which is close to the OECD average of 68 per cent. This means that public investment decisions based on population can favour urban-dwellers, to the disadvantage of citizens living in rural areas. The maintenance of facilities needed for cultural vitality in the regions (including for Māori communities) requires specific attention.

Ngāi Tahu Farming is a major enterprise, managing more than 100,000 ha of farm and forestry land in Te Waipounamu.[36] It explicitly turns to Ngāi Tahu values to guide what it does and how it does it. This includes a responsibility to nurture the environment through the generations, reflecting a Ngāi Tahu Farming whakataukī or proverb: Toitū te Marae o Tāne, Toitū te Marae o Tangaroa, Toitū te Iwi; When land and water are sustained the people will prosper.

There is a strong tradition of family farming in Canterbury, with strong intergenerational cultural values that are often described using words such as pioneering spirit, rugged individualism, hard work, determination, honesty, ingenuity and personal rewards.[37] The strategy of Beef + Lamb New Zealand, for example, defines five essential values: positivity and confidence; fronting up; caring about quality and impact; pushing boundaries; and all voices count.[38]

Beyond the farm gate, there are large agribusinesses in Canterbury whose operations are guided by longstanding cultural values. This includes processors and exporters, but also firms providing services to the food and fibre sector.

[36] https://ngaitahufarming.co.nz/.

[37] See Matthew Rout and John Reid (2019, chapter 6).

[38] https://beeflambnz.com/sites/default/files/content-pages/B%2BLNZ%20Strategy.pdf.

### *5.3.3 Social Capital*

Cultural capital refers to norms and values passed down the generations. In contrast, social capital refers to the shared networks, norms and values that govern interactions among people of the current generation, including across cultural groups. A key aspect of social capital is the degree of trust that can be expected between people who do not know each other. The greater is the level of trust in a community, the easier it is for people to collaborate with each other to create business opportunities or initiate social projects.

People in the Food and Fibre sector have created a wide range of local and national civil society institutions to facilitate collective action for wellbeing. Producer cooperatives are an example of collaboration in market activities. Trust relationships within Food and Fibre value chains are complex. In some value chains, the level of trust is very high, with enduring commitments among participants in the value chain based on shared values rather than formal contracts. In other value chains, participants enter into transactions based on current opportunities rather than with the intention of building long-term relationships.

The development of social capital begins in schools, where children learn how to work together with others outside their immediate family. It is possible for public policy to foster effective networks to increase social capital, and to help enforce shared community norms. Social capital can be strengthened by developing societal aspirations or common goals. Policy can also be developed to expand access to social capital for people who may have been traditionally excluded on the basis of characteristics such as gender or race.

Strong social capital is a feature of the primary sector in New Zealand. An example is the number of A&P shows in the region:[39]

- Amberley (late October, early November)
- Amuri (early March)
- Ashburton (late October)
- Banks Peninsula (mid-January)
- Canterbury (The New Zealand Agricultural Show, Show Week, October)
- Cheviot (mid-March)
- Courtenay, Kirwee (late November)
- Duvauchelle (early January)
- Ellesmere (mid-October)
- Hawarden (mid-March)
- Kaikoura (late February)
- Mackenzie County (early to mid-April)
- Malvern (late March)
- Mayfield (mid-March)
- Methven (mid-March)
- Northern, Rangiora (late October)

[39] See https://www.ras.org.nz/shows-events/central-region/.

- Oxford (early April)
- Southern Canterbury (early to mid-October)
- Temuka and Geraldine (early March)

The Canterbury Show was rebranded as the New Zealand Agricultural Show in 2018. It welcomes more than 100,000 visitors, celebrating all that is great about rural life and looking to promote excellence in agriculture, showcase innovation and provide space for a lot fun to be had by all.[40]

### *5.3.4 Economic Capital*

Economic capital covers three broad categories of long lasting assets: (1) physical assets, including infrastructure, buildings, plant, machinery, vehicles and equipment; (2) financial assets, including equities, shares, debentures, bank deposits and cash; and (3) intellectual property, including patents, trademarks, copyright and registered brands. In each of these categories, investment in economic capital can greatly increase the productivity of an enterprise, and so expand capabilities for wellbeing.

The requirements for economic capital in Food and Fibre enterprises can be very high. Producers typically require specialised structures and machinery that have little alternative uses. A processing plant may require a large financial investment to incorporate the latest technologies that meet strict safety and other standards. The creation of a new plant variety right or a trusted global brand takes years to achieve, requiring access to sufficient financial capital during the development phase.

There is a substantial literature on policies that can support investment in economic capital, since this has been long recognised as a key for higher living standards. These beneficial policies include a fundamental respect for property rights and a stable policy environment.

Canterbury primary producers make substantial investments in on-farm physical capital. A specific issue has been irrigation schemes. Large scale irrigation, such as the Rangitata Diversion Race, were a public work funded by government during the Great Depression of the 1930s.[41] More recently, the Opuha scheme began operations in 1988, and the Waimakariri scheme in 1999.[42] The Central Plains Water project was incorporated in 2003 and by June 2019 was irrigating 50,000 hectares.[43]

### *5.3.5 Natural Capital*

Natural capital refers to the way in which the environment provides services that contribute to the wellbeing of people, sometimes called ecosystem services.[44] The Millennium Ecosystem Assessment (2005, p. v) recognised four major categories: “provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling”.

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[40] https://www.theshow.co.nz/. See also Shiels (2012).

[41] http://www.rdrml.co.nz/about-us/37-the-rangitata-diversion-race.

[42] https://www.irrigationnz.co.nz/Category?Action=View&Category_id=77.

[43] https://www.cpwl.co.nz/wp-content/uploads/2019-Annual-Report.pdf.

[44] Dymond (2013) provides a New Zealand overview.

Food and fibre are explicitly included in the above examples for provisioning services, recognising the essential role of the environment in primary sector production. Production also has potential impacts on the other categories of ecosystems services. It can affect water quality for example (regulating services), recreational opportunities (cultural services) and soil formation (supporting services). Processing, storage and transport also have environmental impacts. These impacts are one of the reasons that the sector recognises the importance of maintaining a social licence to farm.[45]

Humans have long known the importance of reinvestment for maintaining soil fertility; for example, through the application of fertilisers. In the same way, it is possible to take specific actions to diminish or mitigate the negative impacts of the Food and Fibre sector on all the ecosystem services provided by natural capital. These actions typically involve economic costs, and so there are policy questions around what costs are justified by the benefits created and who should bear those costs.

Changes in the Canterbury Food and Fibre sector have had impacts on the region's natural capital, particularly for the quality of local waterways.[46] Expanding dairy farming generally results in more degraded fresh water. This is recognised by the Canterbury Mayoral Forum, which has developed a Canterbury Water Management Strategy with a vision to enable present and future generations to gain the greatest social, economic, recreational and cultural benefits from Canterbury's water resources within an environmentally sustainable framework.[47]

### *5.3.6 Knowledge Capital*

Knowledge capital refers to the way in which scientific research is continuously expanding the stock of human knowledge, leading to technological progress. Knowledge capital has a unique role in economic models of living standards growth. This was recognised in 2018 by the shared award of the Nobel Prize in Economics to Paul Romer in recognition of his "endogenous growth theory", which demonstrates how growth in knowledge capital is the single most important factor for growth in living standards.[48]

No one should doubt that the Food and Fibre sector is highly knowledge-intensive. In New Zealand and globally, technological advances have contributed to high productivity growth in primary sector production and processing. Precision agriculture and food process engineering advances are contributing to further growth. Knowledge intensive business services are enabling enterprises to obtain higher returns from their food and fibre products.

New Zealand has invested in several public institutions that receive funds to increase the stock of knowledge capital for the Food and Fibre sector. This includes the country's Universities (all of which are undertaking research in business services), Crown Research Institutes and Institutes of Technology and Polytechnics. There are also private sector organisations, including the Cawthron Institute based in the Nelson region. A challenge for any national innovation system is to align research effort with genuine commercial opportunities.

[45] See, for example, Rolleston (2015).

[46] See Parliamentary Commissioner for the Environment (2013 and 2015).

[47] Canterbury Mayoral Forum (2009), updated July 2010 and August 2019.

[48] See, for example, Romer (1986, 1994). This is discussed further in Dalziel (2019a).

In Canterbury, there is a cluster of land-based research institutions based around the Lincoln township. This includes Lincoln University, AgResearch, Manaaki Whenua Landcare Research and Plant and Food Research. There are also industrial organisations in the cluster, including DairyNZ and the Foundation for Arable Research. B.linc is hosted at Lincoln University with a mission to help facilitate and grow an exponential innovation ecosystem in agriculture, food and technology.[49] The South Island hub of the New Zealand Food Innovation Network (FOODSOUTH), which focuses on business development for food and beverage companies, is also hosted at Lincoln University.[50]

### *5.3.7 Diplomatic Capital*

Diplomatic capital refers to the institutions and norms that that have been created to foster cross-cultural collaborations on a global scale. This includes practices of state diplomacy that have been developed over centuries, but also includes norms and protocols required by multinational firms and international non-governmental organisations. Strong, effective diplomatic capital is required to address some of the world's most pressing problems that are beyond the scope of any single country (such as global climate change).

In August 2017, New Zealand was party to around 1,900 international treaties.[51] Many international agreements that are entered into by New Zealand are important for the Food and Fibre sector, because of the sector's high reliance on exports. This includes free trade agreements; New Zealand was the first OECD country, for example, to enter into a free trade agreement with China.[52]

The Ministry of Foreign Affairs and Trade is responsible for leading New Zealand negotiations on free trade agreements. The Ministry for Primary Industries works on expanding international market access for New Zealand food and fibre by influencing international trade frameworks and international standards. It is also responsible for maintaining New Zealand's government-to-government 'competent authority' relationships and functions.

The food and fibre sector in Canterbury enjoys the benefits of this work. Another opportunity is that there are a number of international schemes that set sustainability standards for food production and distribution. A good example is GLOBALG.A.P., which offers an independent certification system for Good Agricultural Practice (G.A.P.).[53] The Global Roundtable for Sustainable Beef is another example. It defines sustainable beef as "a socially responsible, environmentally sound and economically viable product that prioritizes: Plant, People, Animals and Progress".[54] Beef + Lamb New Zealand has established a New Zealand chapter of this programme.

Initiatives such as these provide a common language for Food and Fibre producers in Canterbury to communicate with overseas customers about New Zealand sustainability credentials.

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[49] https://www.blincinnovation.com/what-we-do.

[50] https://foodinnovationnetwork.co.nz/locations/foodsouth.

[51] MFAT (2017, p. 4).

[52] MFAT (2008).

[53] https://www.globalgap.org/uk_en/.

[54] https://grsbeef.org/WhatIsSustainableBeef.

## 5.4 Conclusion

The long-term prosperity of the Canterbury Food and Fibre sector depends on the health of the assets discussed in this chapter. The following chapter draws on that conclusion to propose some statistical indicators for monitoring the state of the Canterbury Food and Fibre sector.

# Chapter 6

# Conclusion

## 6.1 Introduction

The final chapter is in two parts. The first part summarises the key messages in each of the previous chapters. The second part offers a set of statistical indicators that are suitable for monitoring the long-term health of the Canterbury Food and Fibre sector.

## 6.2 Key Messages of the Report

The report began by noting that an important feature of the Canterbury economy is the world-class quality of its food and fibre products. This quality begins with the province's land-based producers, but extends to processors and other industries serving the sector to create value for the final consumers. These interconnections between producers and other parts of the economy mean that land-based enterprises make important contributions to urban economies.

There are a large number of businesses in Canterbury's Food and Fibre production sector. In 2019, for example, there were 9,531 businesses in agriculture, forestry and fishing, employing 16,400 people. The Food and Fibre processing industries in Canterbury in 2019 was made up of 1,017 enterprises, employing another 17,280 people. These figures mean that 15 per cent of all Canterbury businesses are in the food and fibre sector and 11 per cent of employees.

A large part of food and fibre produced in New Zealand is exported to overseas consumers. This includes 95 per cent of milk production, 90 per cent of sheepmeat and 80 per cent of beef production. The total value of Food and Fibre exports shipped from Canterbury's three ports (Lyttelton, Timaru and Christchurch International Airport) amounted to $5.8 billion in 2018.

In 2017, the Food and Fibre production industries in Canterbury contributed $2.4 billion to the Canterbury economy, or 7 per cent of the region's gross domestic product. The processing industries contributed $3.1b and the industries servicing the producers and processors contributed a further $0.8 million. Thus the combined activities of these three groups of enterprises amounted to 19 per cent of the Canterbury economy.

In 2016, the total agricultural area in Canterbury was 2,595,880 hectares, which was a decline of 18 per cent from 2012. In 2016, 66 per cent of agricultural land use was sheep and beef and 16 per cent for dairy farming. Between 2012 and 2016 the area used for dairy farming more than doubled (+155 per cent), while the area used for sheep and beef dropped by almost a third. Grain growing also increased by 57 per cent over the period with other land uses falling.

Canterbury has an area of 94,782 hectares of forest with a standing volume of 26,474 cubic metres. Canterbury is the fourth largest wine region in New Zealand after Marlborough, Hawkes Bay and Otago. In 2019, 1,383 hectares in Canterbury was used for viticulture, and the region had 68 wineries.

The Primary Sector Council recently offered a vison of New Zealand's food and fibre sector as providing the world's most discerning consumers with outstanding, ethically produced food, natural fibres, drinks, co-products and bio-products, all sourced from our land and oceans. Te Hono, whose Directorate is based in Canterbury, is an outstanding example of a trans-sector movement promoting a vision for transformation from volume to value.

There are marketing opportunities and challenges in communicating the quality of New Zealand food and fibre, including their credence attributes. Credence attributes are those product qualities that cannot be immediately seen or experienced in relation to the product, and so rely on consumer trust, supplier communication or independent verification. Examples of credence attributes include food safety, environmental stewardship, animal welfare, social responsibility, cultural authenticity, fair trade, functional foods, organic production, GM-free, water footprint, biodiversity and local foods.

In 2012, the Agribusiness and Economics Research Unit (AERU) initiated research to explore how international consumers of agri-food products interpret and value credence attribute claims of their purchases. This began with pilot surveys of consumers in India, China and the United Kingdom (UK), which found that consumers in China and India were willing to pay large additional premiums for food safety, farm animal welfare, water pollution minimisation, greenhouse gas minimisation, biodiversity enhancement and New Zealand country-of-origin attributes relative to their UK counterparts.

That research was followed by an MBIE-funded programme called *Maximising Export Returns*, active from 1 October 2013 to 30 September 2016. This comprised original research in five important markets for New Zealand agri-food exports: China, India, Indonesia, Japan and the United Kingdom. Again, results from the choice experiments in these markets indicated that consumers in developing countries were willing to pay much higher premiums for the inclusion of credence attributes in food products relative to their developed country counterparts.

Further research funded by the OLW National Science Challenge involved choice experiments in four key markets: wine and beef in California; and kiwifruit and yoghurt in Shanghai. Sauvignon blanc consumers in California, for example, revealed they were willing to pay a premium of over 30 per cent for 100% organic wine and 25% for wine made with organic grapes, and similar premiums were found for pest and disease management, for water management and for by-products management. The study also found that Californian consumers were willing to pay a premium for wine produced in the United States, but New Zealand Sauvignon blanc enjoys a comparable premium, considerably higher than for Sauvignon blanc produced in Chile, France or South Africa.

Another research programme funded by MBIE is ongoing. A feature of this work is that it aims to analyse different market segments within the country by using statistical methods to identify groups of consumers that share similar characteristics. Indeed, preliminary results from the survey of United Kingdom consumers revealed that one of three identified groups revealed a considerably higher premium for New Zealand lamb than the other two groups. This was in contrast to their generally lower willingness-to-pay for other attributes. This indicates the potential for greater rewards if New Zealand exporters can target specific market segments in each country.

A key factor that may contribute to consumer trust is the country-of-origin of the food or beverage being purchased. Indeed, country-of-origin labelling may be used by consumers as a cue for judging

attributes such as quality and food safety. This means that countries and regions need to pay attention to creating strong narratives for consumers of their food and fibre products. Consistent with that insight, the New Zealand Government launched an initiative in 2013 to help develop New Zealand's International marketing brand, called the New Zealand Story. Canterbury also has a proud story to tell about its history of food and fibre production.

Indeed, for many products it is not so much individual firms competing against each other as value chains competing against other value chains. This paradigm shift implies that firms within value chains must adopt a market orientation, which means focusing on communicating with consumers in order to understand their needs and then disseminating this information across the chain in order to make decisions about production, value-adding processes, and marketing. When a chain adopts this view it has the ability to develop a competitive advantage and superior long term chain performance.

Research funded by the Our Land and Water National Science Challenge explored several value chain attributes through an examination of five New Zealand based value chain case studies.[55] This research identified key factors that characterised successful value chains. Not surprising, a key finding was that all of the five value chains adopted a strong consumer focus, or placed a large emphasis on *manaakitanga* for consumers. Information sharing was found to be critical among chain members and this was largely facilitated by the lead firm in the chain.

In May 2018, the New Zealand Government presented the world's first Wellbeing Budget, reflecting a global movement towards a wider focus on broad indicators of wellbeing in public policy. A wellbeing economics framework recognises that sustainable prosperity requires attention to the nation's capital stocks. The AERU framework identifies seven capitals: human capital; cultural capital; social capital; economic capital; natural capital, knowledge capital; and diplomatic capital. All of these capital types are important for the long-term prosperity of the Canterbury Food and Fibre sector.

## 6.3 Statistical Indicators

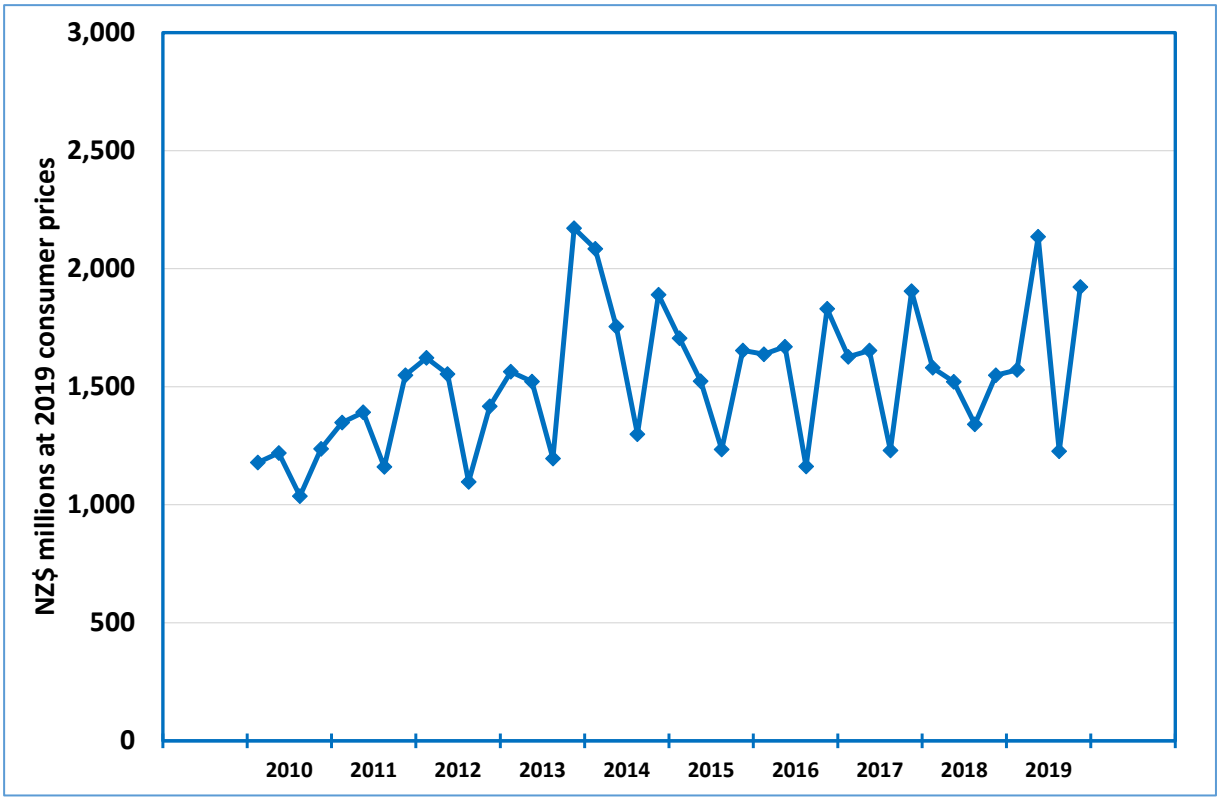
The report concludes by proposing eight statistical indicators for monitoring the long-term health of the Canterbury Food and Fibre sector.

1. Food and Fibre Exports from Canterbury
2. World Population with New Zealand Free Trade Agreement
3. Total Area of Farms in Canterbury
4. Groundwater Quality in Canterbury
5. Drought Conditions in Canterbury
6. Domestic Enrolments in Agriculture, Environmental and Related Bachelor Degrees, NZ
7. Serious Work-related Injuries in Agriculture, Forestry and Fishing, Canterbury
8. Number of Researchers at Lincoln University

[55] See McIntyre *et al*. (2019).

*Indicator 1 Food and Fibre Exports from Canterbury*

**Figure 6.1 Value of Food and Fibre Exports through Canterbury Ports, NZ$ millions at 2019 Consumer Prices, 2010–2019**

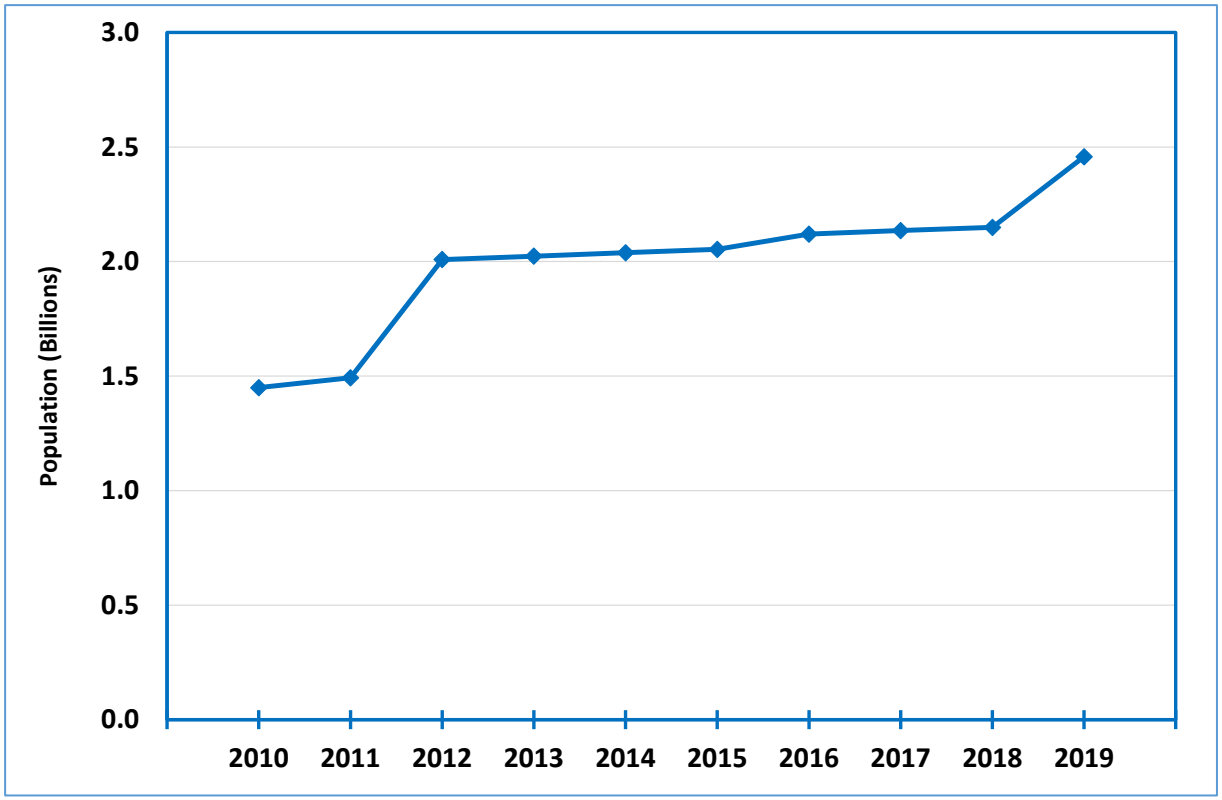



| | |
|---|---|
| Description: | The value of food and fibre exports passing through Lyttelton Port, Timaru Port and Christchurch International Airport. |
| Primary Data Source: | Statistics New Zealand |
| Data Details: | Exports for Overseas Cargo (fob NZ$): New Zealand Port by Country of Destination, Commodity (HS2) and Period, available at NZ.Stat. Selected Food and Fibre HS2 commodities are 01-24 and 41-53. |
| Secondary Analysis: | The raw data must be downloaded and aggregated. An adjustment must also be made for inflation, using the consumer price index, available from Statistics New Zealand or the Reserve Bank of New Zealand. |
| Data Availability: | Monthly |

| | |
|---|---|
| Rationale: | Because so much primary production in Canterbury is for export, this statistic is a good indicator of the sector's overall prosperity. Further, because its focus is on values rather than volumes, this indicator is consistent with the policy aim of capturing greater value. |
| Commentary: | The series has a strong seasonal pattern, which could be adjusted if required. Between 2010 and 2014, there was strong growth, fuelled by a doubling of dairy product exports through the three ports, from $1,834 million in 2010 to $3,637 million in 2014. Food and fibre exports fell back in 2015, after which export values were static, at least until 2019. |

*Indicator 2 World Population with New Zealand Free Trade Agreement*

**Figure 6.2 Total Population of Countries in Free Trade Agreements with New Zealand, Billions, June 2010–2019**

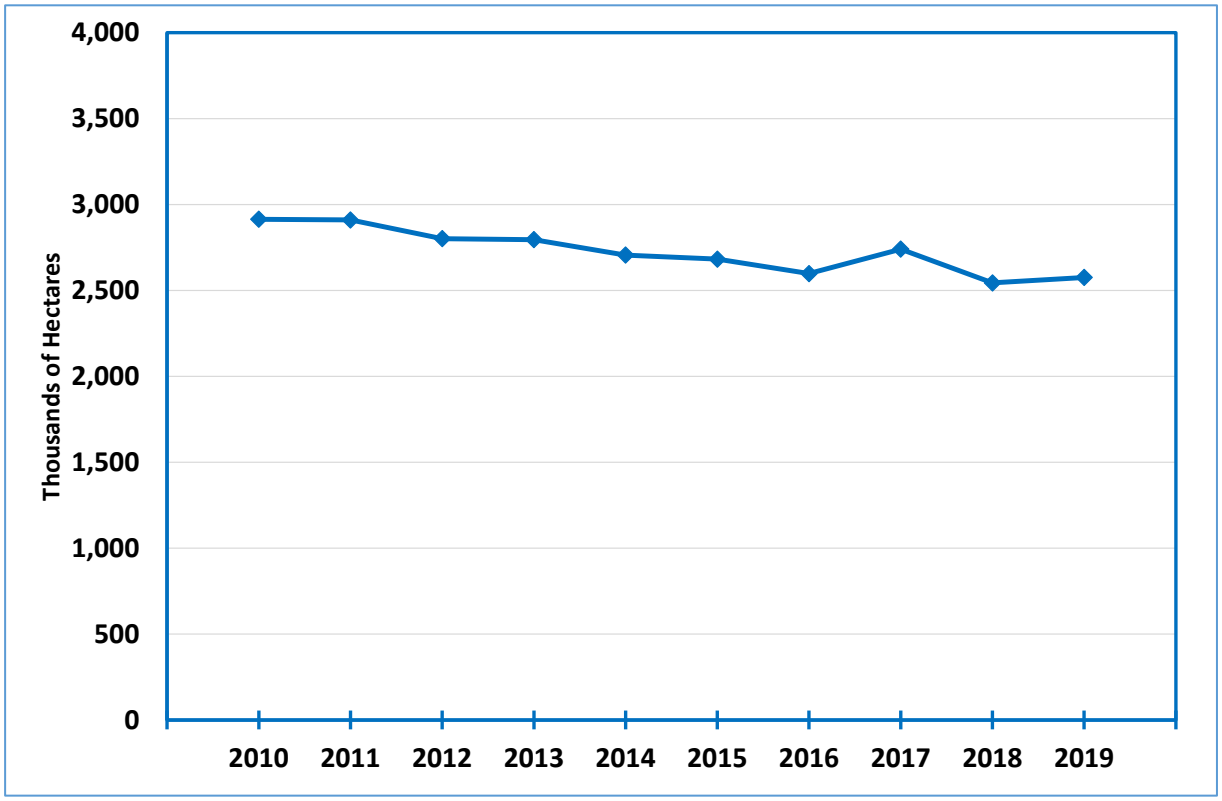



| | |
|---|---|
| Description: | Midyear estimates of total population (all residents regardless of legal status or citizenship) of countries with a free trade agreement in force in New Zealand. |
| Primary Data Source: | Ministry for Foreign Affairs and Trade, and World Bank |
| Data Details: | List of Free Trade Agreements in Force, published on the MFAT website. Population, total, published on the World Bank World Development Indicators website. The 2019 figure is an AERU estimate. |
| Secondary Analysis: | The raw data can be downloaded without further analysis. |
| Data Availability: | Annual |

| | |
|---|---|
| Rationale: | A Free Trade Agreement facilitates access for New Zealand exports, with its significance related to the size of the population in the trading partner. |
| Commentary: | The number of people living in countries with a Free Trade Agreement in force with New Zealand has increased sharply over the decade. This is partly due to population growth, but the bigger impacts were due to the ASEAN-Australia-New Zealand free trade agreement (AANZFTA, which came into force in January 2012) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP, which came into force on 30 December 2018. |

*Indicator 3 Total Area of Farms in Canterbury*

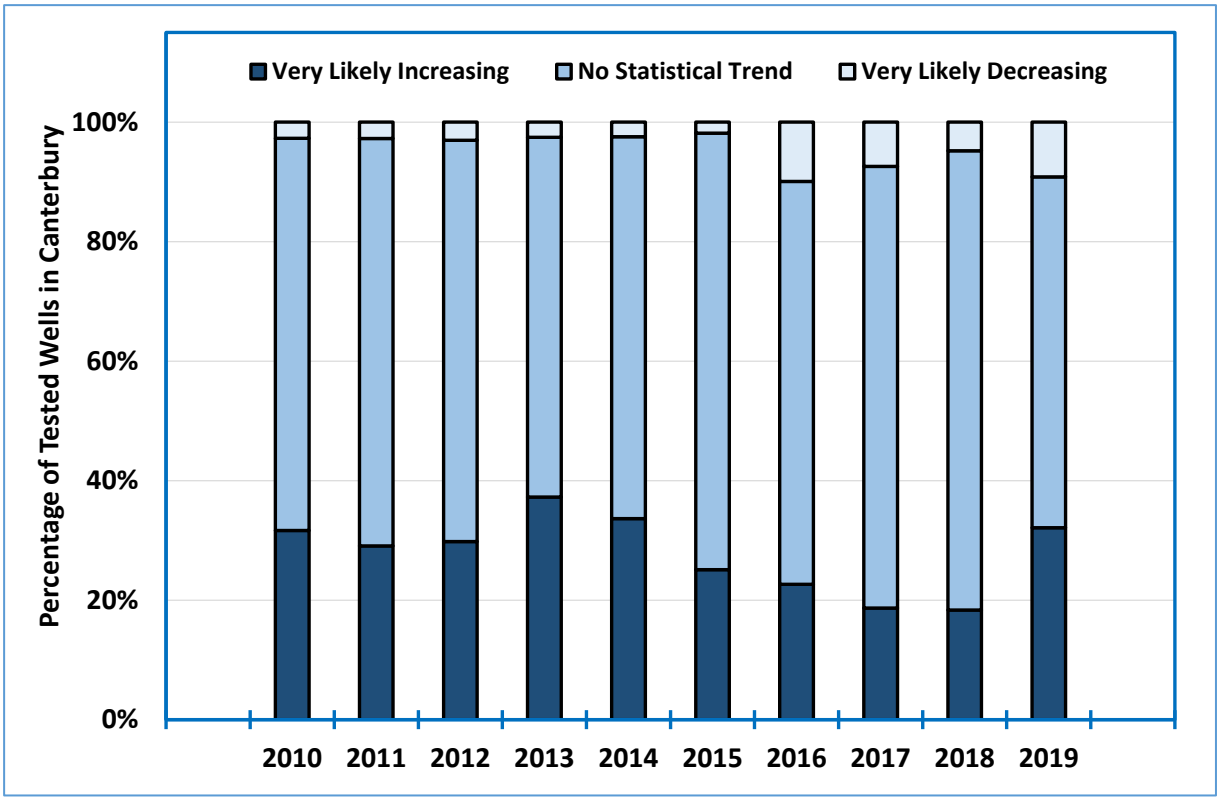
**Figure 6.3 Total Area of Farms, Canterbury, Hectares, June 2010–2019**




| | |
|---|---|
| Description: | The total area in Canterbury recorded a being used for agricultural production activity (including livestock, cropping, horticulture, and forestry). |
| Primary Data Source: | Statistics New Zealand |
| Data Details: | Total Area of Farms by Regional Council, published on Infoshare. |
| Secondary Analysis: | The raw data can be downloaded without further analysis. |
| Data Availability: | Annual |

| | |
|---|---|
| Rationale: | The raw material for the food and fibre sector comes from the land, so that the total area of farms is a good indicator of trends in the land asset base of the sector. |
| Commentary: | The total area of farms has been declining slowly over the last decade. |

**Figure 6.4 Long-term Trends of Nitrate-Nitrogen in Groundwater, Statistical Analysis over Ten Year Periods, Canterbury, Per Cent, 2010–2019**




Description: Environment Canterbury samples groundwater from around 300 wells in Spring each year, and tests the samples against a number of health-based acceptable values and aesthetic-based guideline values. It is possible to undertake a statistical analysis of trends for around 200 of these wells. The figure shows the percentage of wells for which the long-term trend (defined over the previous ten years) of nitrate-nitrogen is very likely increasing or very likely decreasing. The remainder are shown as no statistical trend.

Primary Data Source: Environment Canterbury.

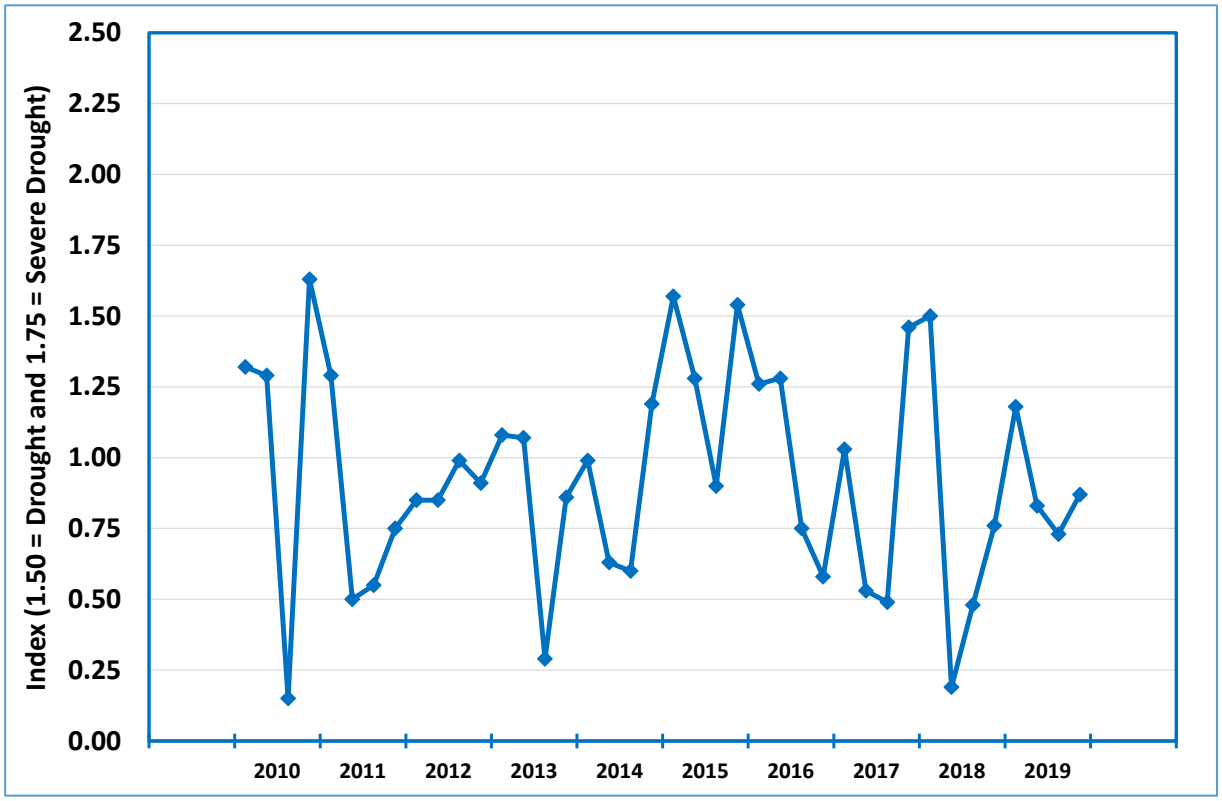
Data Details: Data table in *Annual Groundwater Quality Survey*, published on-line by Environment Canterbury every year.

Secondary Analysis: The raw data can be downloaded without further analysis.

Data Availability: Annual

| | |
|---|---|
| Rationale: | Groundwater quality is a major policy concern in Canterbury, and is affected by nitrogen leaching from agricultural production. |
| Commentary: | The percentage of wells for which the long-term trend of nitrate-nitrogen is very likely increasing has been falling over the last decade, although there was an increase in the 2019 survey. The percentage of wells for which the long-term trend of nitrate-nitrogen is very likely decreasing appears to have increased after 2015. |

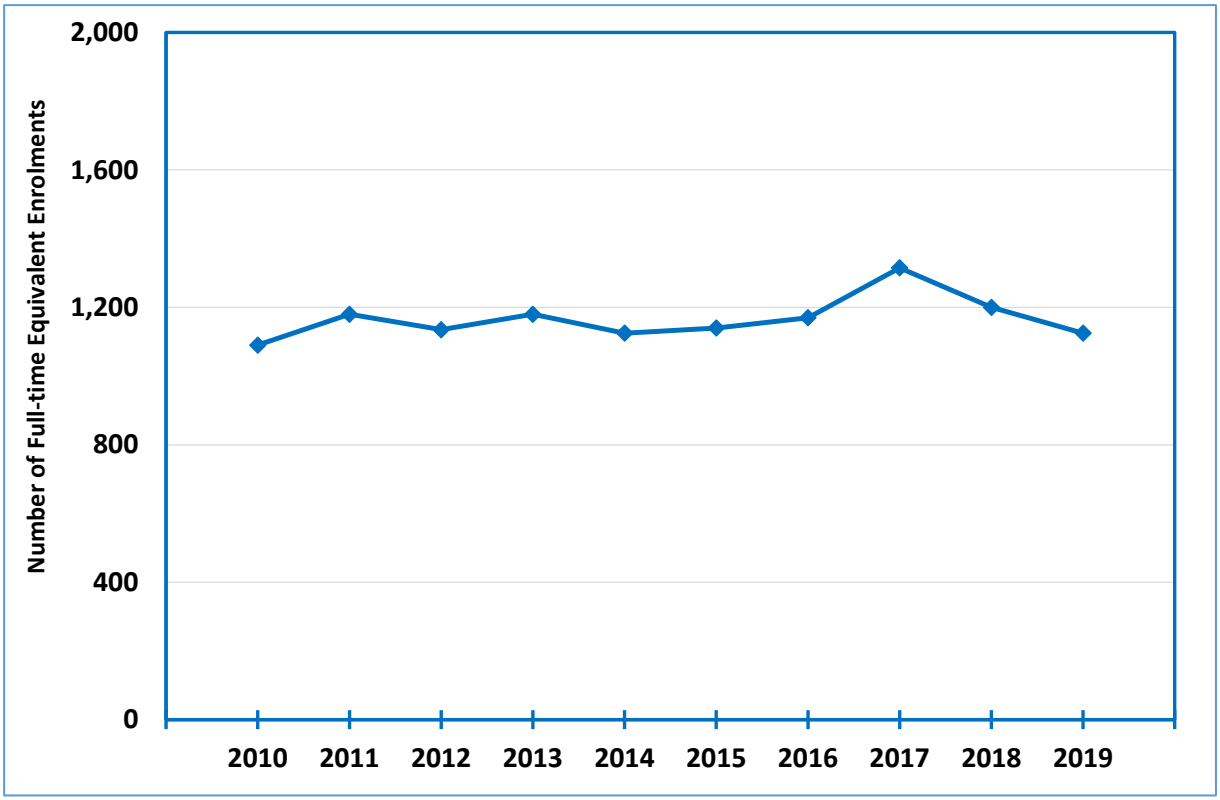
**Figure 6.5 New Zealand Drought Index, Canterbury, Maximum Value in the Region, 2010–2019**




| | |
|---|---|
| Description: | New Zealand Drought Index (NZDI), is a climate data-based indicator of drought based on four commonly-used climatological drought indicators. This statistic is available daily for 19 sub-regions in Canterbury. The indicator plots the maximum recorded value during the quarter. |
| Primary Data Source: | NIWA. |
| Data Details: | New Zealand Drought Monitor, published on the NIWA website. |
| Secondary Analysis: | The raw data must be downloaded for each sub-region and then analysed each quarter to determine the maximum value recorded during the period. |
| Data Availability: | Quarterly. |

| | |
|---|---|
| Rationale: | Canterbury has experienced periods of drought, which reduces the productivity of primary production. |
| Commentary: | The index has five categories: Dry (>0.75), Very Dry (>1.0), Extremely Dry (>1.25), Drought (>1.5) and Severe Drought (>1.75). Parts of Canterbury frequently experience dry conditions, but no severe drought in the last decade. (For comparison, the value of the NZDI for the Far North was generally above 1.5 between 23 January and 26 March 2020, peaking at 2.14 at the end of February.) |

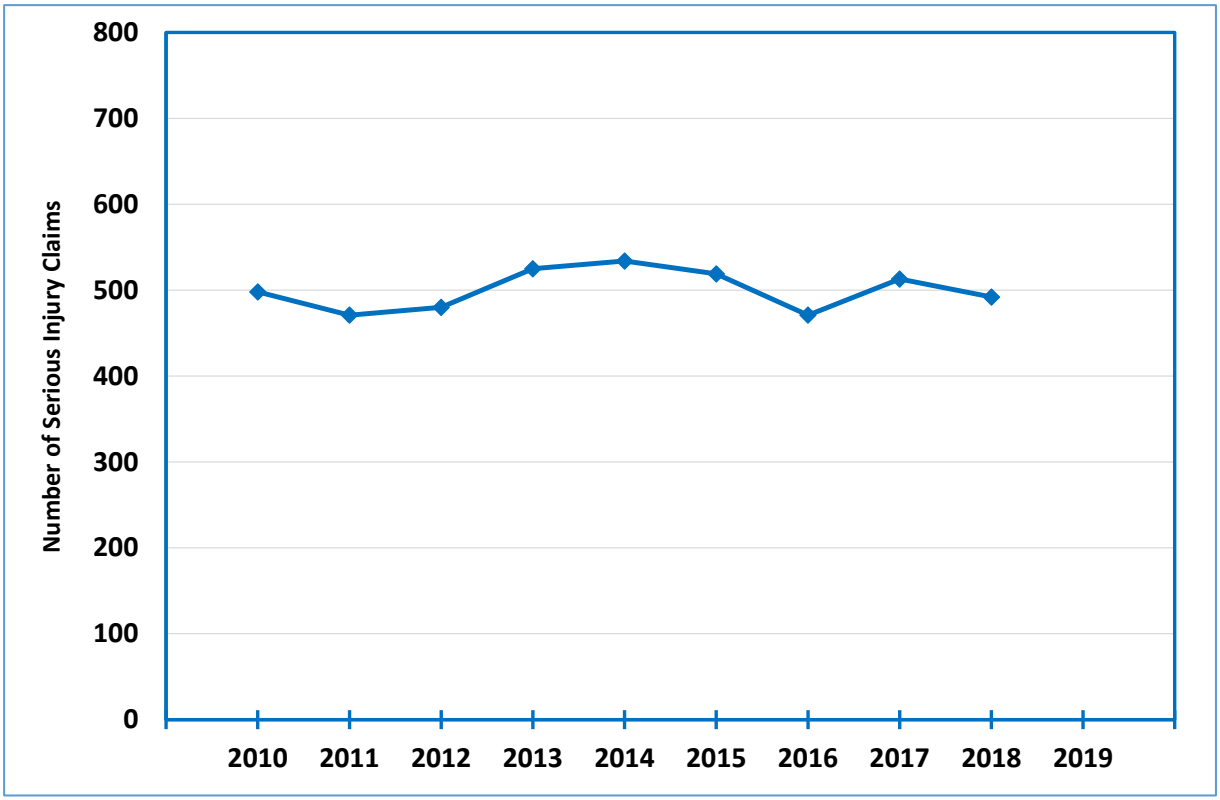
**Figure 6.6 Domestic Students Enrolled in Agriculture, Environmental and Related Bachelor Degrees, Full-time Equivalent, New Zealand Tertiary Education Institutions, 2010–2019**




| | |
|---|---|
| Description: | The full-time equivalent number of domestic students enrolled in agriculture, environmental and related studies at the Bachelor degree level in New Zealand Tertiary Education Institutions. |
| Primary Data Source: | Education Counts. |
| Data Details: | Table FOS.EFT.3 in the Provider-Based-Equivalent-Full-Time-Field-of-Study spreadsheet, published on the Education Counts website. |
| Secondary Analysis: | The raw data can be downloaded without further analysis. |
| Data Availability: | Annual. |

| | |
|---|---|
| Rationale: | This series is a good indicator of the New Zealand tertiary education sector's contribution to providing advanced human capital available for the country's Food and Fibre sector. |
| Commentary: | The number of completions dropped sharply in 2012; this was due to a fall in graduate certificates, diploma and Master's qualifications (generally 1 to 2 year courses) after the 2011 earthquakes. The number of completions has been rising in recent years. |
| Important Note: | Enrolments in other degrees are relevant for the food and fibre sector (soil science, for example, or food science and biotechnology), but this series is the easiest available from a public source for commenting on trends. |

**Figure 6.7 Number of Work-related ACC claims, Agriculture, Forestry and Fishing, Canterbury, 2010–2018**




| | |
|---|---|
| Description: | The number of claims accepted by the Accident Compensation Corporation (ACC) for work-related injury in the agriculture, forestry and fishing industry in Canterbury. |
| Primary Data Source: | Statistics New Zealand. |
| Data Details: | All claims for work-related injury by industry and territorial authority, available at NZ.Stat. |
| Secondary Analysis: | The raw data is at the territorial authority level, and so must be aggregated for the Canterbury region. Figure 6.7 includes Kaikoura, Hurunui, Waimakariri, Christchurch, Selwyn, Ashburton, Timaru, Mackenzie, Waimate and Waitaki. The industry is Agriculture, forestry and fishing. The severity of injury is more than a week off work. |
| Data Availability: | Annual. |

| | |
|---|---|
| Rationale: | Serious work-place injuries impose financial and personal costs and are more common in the primary sector than other parts of the economy. |
| Commentary: | The agriculture, forestry and fishing industry in Canterbury has about 500 work-related injuries each year, in which the injured person is more than a week off work. |

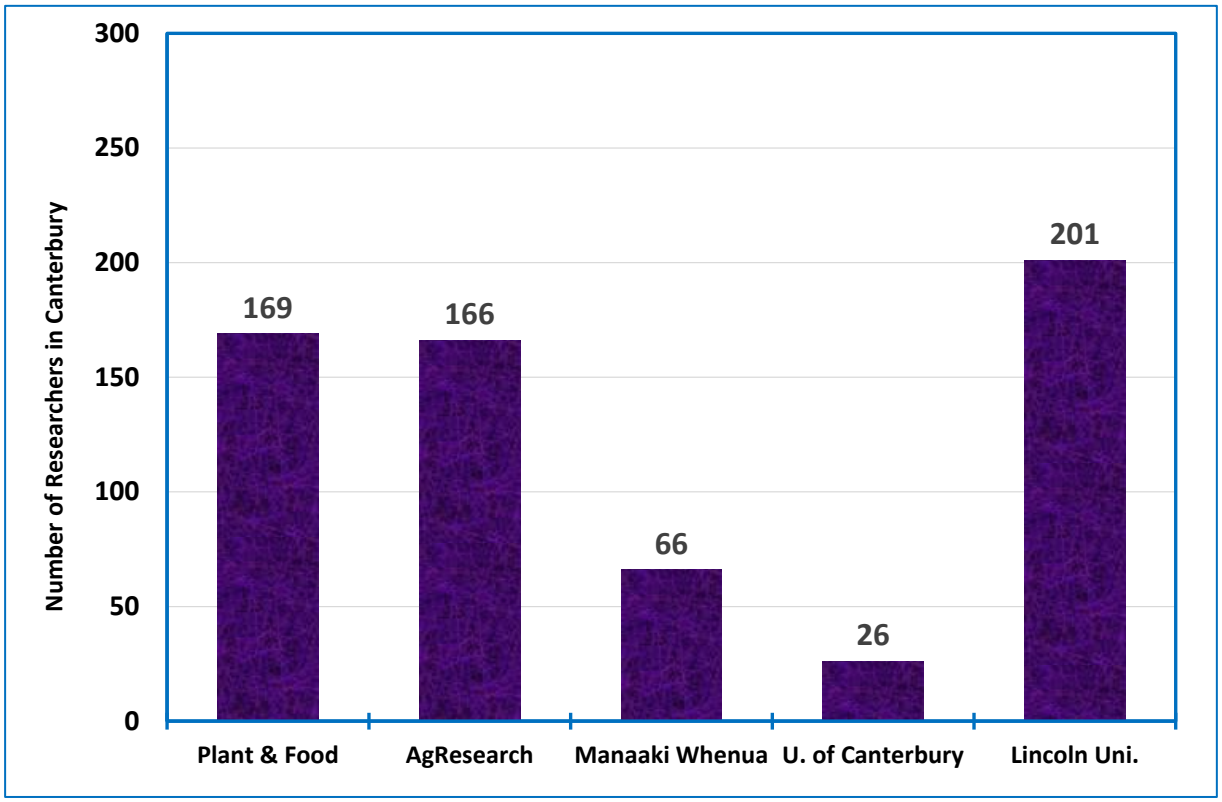
*Indicator 8 Public Researchers in the Canterbury Food, Fibre & Agritech Sector*

Section 5.3.6 observed that economists have demonstrated that growth in knowledge is the single most important factor for growth in living standards. It also observed that the Canterbury food and fibre sector has access to a cluster of land-based research institutions based around the Lincoln township. This includes Lincoln University, AgResearch, Manaaki Whenua Landcare Research and Plant and Food Research. The University of Canterbury also creates new knowledge relevant to the sector.

Unlike the previous seven indicators, there is no public data source that can be used to monitor trends in the amount of research effort from these institutions relevant to the Canterbury food and fibre sector. All five institutions employ researchers whose work is not directly connected to the food and fibre sector, and the three Crown Research Institutes have campuses in other parts of New Zealand, as well as at Lincoln.

Consequently, ChristchurchNZ approached the five organisations to ask them to provide data on the number of researchers working in the organisation in Canterbury where the majority of their research outputs directly or significantly contribute to the food, fibre and agritech sector. Figure 6.8 presents the responses.

**Figure 6.8 Number of Public Researchers in the Canterbury Food, Fibre & Agritech Sector, 2020**

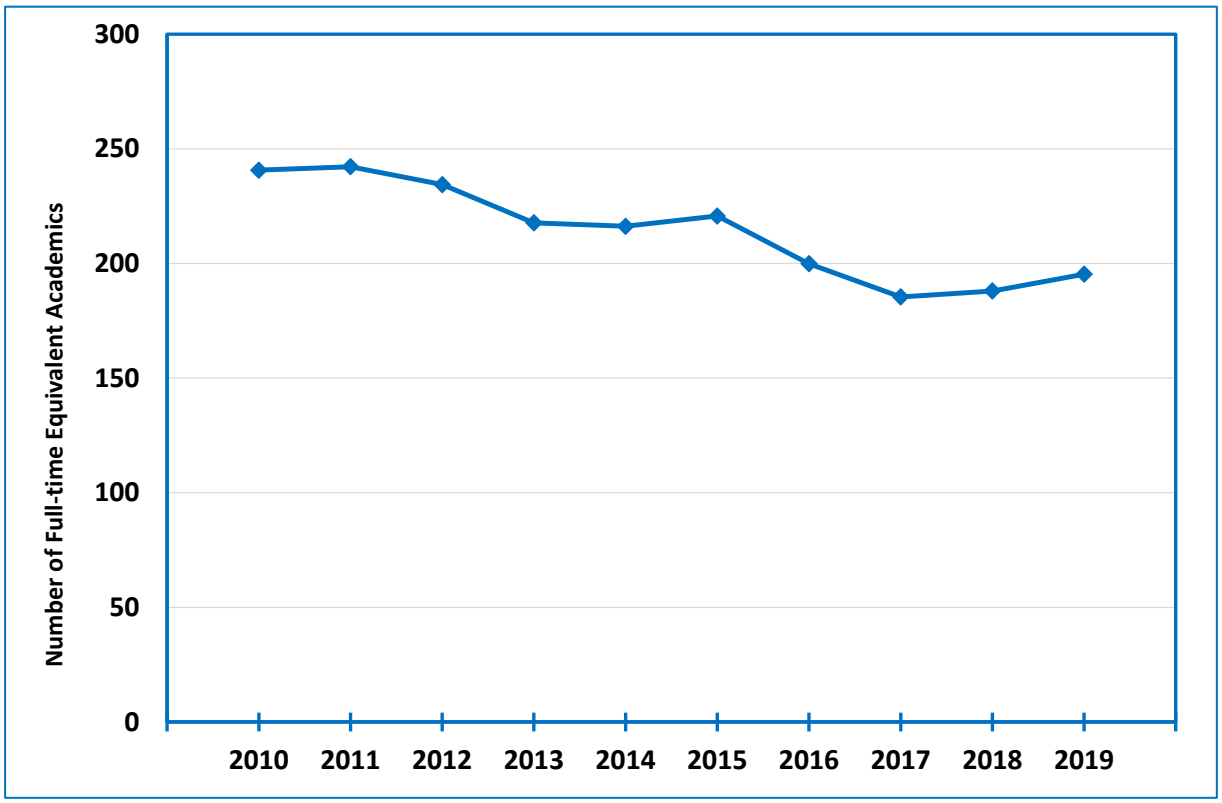



*Source:* The five institutions, responding to a request from ChristchurchNZ.

The authors are grateful to the five institutions and for ChristchurchNZ for producing the data in Figure 6.8. The figure provides a good snapshot at a moment in time. If Canterbury Food and Fibre Innovations required a time series to report on trends in the region, it could repeat this survey each year.

If Canterbury Food and Fibre Innovations needed to rely on publicly available data to monitor trends, the authors suggest that the best available trend is total number of academics at Lincoln University. The Lincoln University series is not a perfect proxy, but employment data for the Crown Research Institutes are not publicly available at the regional level, and the number of relevant researchers at the University of Canterbury is relatively small. The Lincoln University trend is shown in Figure 6.9.

**Figure 6.9 Number of Full-time Equivalent Academics at Lincoln University, 2010–2019**




| | |
|---|---|
| Description: | The number of full-time equivalent academics employed at Lincoln University. |
| Primary Data Source: | Lincoln University. |
| Data Details: | Lincoln University *Annual Reports*. |
| Secondary Analysis: | The raw data can be downloaded without further analysis. |
| Data Availability: | Annual. |

| | |
|---|---|
| Rationale: | The creation of new knowledge by researchers is essential for innovation and economic prosperity. |
| Commentary: | The number of academic staff at Lincoln University has declined since 2010. |
| Important Note: | Ideally, this indicator should be the total number of researchers focused on food and fibre research in Canterbury. This would include other organisations in the Lincoln cluster, including researchers and technicians employed at AgResearch, Manaaki Whenua Landcare Research and Plant and Food Research. It would also include Canterbury-based researchers in other institutions associated with the Kiwi Innovation Network, including the University of Canterbury, ESR, NIWA, Scion and the New Zealand Health Innovation Hub. The AERU was unable to find any public source for the number of relevant researchers in these institutions based in Canterbury. |

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