



**TE RĀNGAI RANGAHAU, PŪTAIAO, AUAHA O
MANAWATŪ ROHE
MANAWATŪ REGION
RESEARCH, SCIENCE AND INNOVATION SECTOR**

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Executive Summary

The purpose of these economic sector profiles for the Manawātū region is to describe the contribution of key sectors to the economic wellbeing of the region. Seven sectors are expected to contribute to a significant share of future growth in the number of jobs and incomes in the region over the next 25 years. They are healthcare, public administration (including defence), logistics, construction, tourism, professional, scientific and technical services, and manufacturing.

Research, science and technology have long been recognised in economic theory and in government policy internationally as important to increasing quality of life and future prosperity. In New Zealand, the government has been a significant funder of research and development activity, with significant funding flows currently through Crown Research Institutes (CRIs) and universities. Funding is also provided through research grants to private businesses, independent research institutes and other not-for-profit institutions, and more recently through tax credits for businesses.

Enhancing economic growth is a primary focus of central and local government and is achieved through a steady process of increasing productive capacity of the economy, and hence increasing national income. There is still widespread debate on the primary drivers of economic growth but the main determinants are the rate of growth of the labour force, the proportion of the national income saved and reinvested and the rate of technological improvements (including increasing skill of the labour force, and managerial efficiency).

The research, science and technology sector is a significant contributor to the Manawātū regional economy (Palmerston North City and Manawātū District) through the employment of researchers and support staff and

the creation of knowledge, which assists the growth of other business based in the city and the wider region. The sector is also important to economic development in the city because of the skilled migrants and international students it brings to the city and the businesses which are attracted to the city because of the presence of strong research, science and technology, and education.

Measuring the economic benefits derived from research and development (R&D) activity in the region is not straightforward. While there are several major institutions in the city which are primarily focussed on research and development outputs, the activity of research, science and technology is spread across many government, not-for-profit and private sector institutions. Research and development activity nationally is measured regularly through bi-annual surveys by Statistics New Zealand. The survey collects data from organisations at a national level but does not identify the regional activity of major institutions. Measuring the flow-on impacts of that research and development activity on the local commercial sector, through the number of new businesses developed, new or improved products created or improved productivity, is even harder to measure at a local level.

EMPLOYEE COUNT



2,500

3.9% of total employment

EARNINGS



\$99M

3.0% of total earnings

GDP



\$222M

3.4% of total GDP

The presence of a major university, several significant Crown Research Institutes, research associations and major business research centres in the region provide significant wealth for the region through the salaries and wages paid and the associated commercial development of knowledge developed in the region. Estimates prepared by the Council using national and regional Statistics New Zealand data suggest that:

- an estimated 2,500 were people directly employed in research in the region (3.9 percent of the workforce in the region in 2020).
- estimated salaries and wages paid to employees in the research and development sector in the region were \$99 million in 2019 (3.0 percent of total salaries and wages paid in the region).
- total research expenditure is estimated to have been \$188 million, 4.1 percent of the national total in 2020.
- the estimated GDP of the research, science and technology sector in the Manawātū region was \$222 million in 2020, 3.4 percent of total GDP in the region.

The following estimates are based on the Statistics New Zealand Research, Science and Technology 2020 survey, Statistics New Zealand annual employee counts for scientific research organisations in the region and data provided by Massey University:

| Estimated research and development expenditure (2020) | Manawātū region (\$ million) | New Zealand (\$ million) |
|--|------------------------------|--------------------------|
| Business expenditure on R&D | 61 | 2,709 |
| Higher education R&D | 89 | 1,082 |
| Crown research institute and other government institutions | 38 | 758 |
| Total estimated R&D expenditure | 188 | 4,549 |

The concentration of research expertise within the city is demonstrated by annual employment data published by Statistics New Zealand, which shows that Palmerston North has the second highest number of people employed in dedicated research organisations, second only to Auckland. These figures cover research across all discipline areas, and data from the public sector research organisations show more food related researchers are located in Palmerston North than Auckland.

Central Economic Development Agency (CEDA) has managed the Callaghan Innovation programme since July 2015 and has overseen a steady increase in R&D activity, especially in the agritech and digital sectors. There has been an increase in the level of student funding that Callaghan Innovation provides to allow companies to utilise the skills and knowledge of tertiary students.

The Manawatu region has significant strengths in food innovation. The university, CRI and business research and development organisations previously described have extensive food-related expertise. These are further complemented by a range of other food focused collaborative organisations including FoodHQ, the Riddet Institute Centre of Research Excellence, the Hopkirk Institute, the New Zealand Food Safety Science and Research Centre and the New Zealand Leather and Shoe Research Association. This is New Zealand's most significant concentration of food science and innovation capability, and collectively is arguably the largest food innovation centre in the Southern Hemisphere.

These strengths in food innovation are key to the future economic development potential for the region and New Zealand. Significant opportunities exist to add value to primary products produced in New Zealand, develop new primary sector opportunities, industrial processing machinery, technology, and software that supports food innovation. These could lead to the export of intellectual property, food ingredients and products, processing equipment or software.

Economic benefits from commercialisation of R&D

Economic benefits also occur in the city and broader Manawātū region from the commercialisation of knowledge from research and development activities. The commercialisation of knowledge is more likely to be based on knowledge developed from R&D conducted in the city but is not solely dependent on locally sourced knowledge. Location linkages are obvious from the strength the city has in the agricultural machinery and equipment manufacturing sector. In 2020 there were nine manufacturing business units producing agriculture machinery and equipment, employing 220 people in the Manawātū region, 10 percent of national employment in the sector.

Introduction

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Technology is an important factor determining differences in wealth between different communities which have equal access to the primary inputs for production (land, labour and capital). Technological sophistication, rarity and demand determine the price and value of a product or service. Technology also allows more output to be produced from the same quantity of inputs. Technology, therefore, is inextricably linked to the creation of profits, jobs, and economic growth.

Increased wealth is created in a community through:

- Creation of new products, process and services
- Creation of new industries
- Improvements in productivity

Research, science and technology play an important role in each of these wealth creation opportunities but the sector is also an important direct contributor to employment and wealth in the Manawatū regional economy.

The purpose of this profile document is to identify:

- The direct economic contribution of the research, science and technology sector to employment and economic activity in the Manawatū region.
- The indirect economic contribution of the sector to employment and economic activity in the Manawatū region and growth in its population.
- Opportunities to enhance growth in the sector through:
 - Increasing the level of the research, science and technology sector employment and economic activity in the Manawatū region
 - Increasing the local commercialisation of research, science and technology in the city and wider region.

Definition of research and development

The definition used by Statistics New Zealand for research and development is:

Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge. Any activity classified as R&D is characterised by originality. Investigation is a primary objective.

Surveying research and development activity

The Statistics New Zealand Research and Development (R&D) survey has been produced for 29 years and has provided useful data on growth in R&D activity by the business and government sector and the distribution of R&D expenditure by activity. The survey does not include a regional expenditure question so the production of regional R&D expenditure data is not possible.

Statistics New Zealand published regional R&D estimates in 2007 for the 2002 period but has not repeated the regional estimates due to changes in the R&D survey and there has been a lack of any regional weighting in the

surveys since 2002. As a result, estimates have been made for regional R&D activity using annual industry employment data published by Statistics New Zealand

| Published Industry ⁽²⁾ | 2006 | 2010 | 2012 | 2014 | 2016 | 2018 | 2020 | Change in expenditure 2006 to 2020 | |
|---|--------------|------------|--------------|--------------|--------------|--------------|--------------|------------------------------------|------------|
| | \$ (million) | | | | | | | \$ (million) | Percent |
| Business sector | | | | | | | | | |
| Primary | 72 | 72 | 125 | 92 | 96 | 98 | 101 | 29 | 40 |
| Manufacturing | 442 | 440 | 536 | 522 | 671 | 673 | 825 | 383 | 87 |
| Food manufacturing | - | - | 109 | 81 | 110 | 74 | 108 | | |
| Beverage and tobacco manufacturing | - | - | 5 | 8 | 7 | 9 | 12 | | |
| Textiles, clothing, footwear, and leather manufacturing | 7 | 6 | 7 | 11 | 6 | 9 | 12 | 5 | 71 |
| Petroleum, coal, chemical, and associated product manufacturing | 99 | 71 | 72 | 93 | 76 | 119 | 82 | -17 | -17 |
| Non-metallic mineral product manufacturing | - | - | 4 | 2 | 3 | 3 | 2 | | |
| Metal product manufacturing | 19 | 27 | 31 | 28 | 67 | 71 | 93 | 74 | 389 |
| Machinery and equipment manufacturing | 195 | 243 | 295 | 287 | 392 | 372 | 497 | 302 | 155 |
| Other manufacturing | 16 | 8 | 14 | 11 | 10 | 17 | 18 | 2 | 13 |
| Services | 409 | 459 | 532 | 632 | 835 | 1,362 | 1,784 | 1,375 | 336 |
| Wholesale trade | 61 | 59 | 89 | 96 | 111 | 233 | 174 | 113 | 185 |
| Scientific research and technical services | 58 | 53 | 51 | 57 | 75 | 118 | 181 | 123 | 212 |
| Computer services | 163 | 190 | 221 | 311 | 436 | 582 | 924 | 761 | 467 |
| Other services | 126 | 157 | 171 | 168 | 212 | 428 | 505 | 379 | 301 |
| Total business sector | 923 | 971 | 1,193 | 1,246 | 1,602 | 2,134 | 2,709 | 1,786 | 193 |
| Government (excluding higher education) sector | | | | | | | | | |
| Scientific research | 484 | 542 | 536 | 557 | 589 | 762 | 671 | 187 | 39 |
| Other government research | 100 | 73 | 60 | 65 | 69 | 66 | 86 | -14 | -14 |
| Total government sector (excl higher education) | 584 | 615 | 596 | 622 | 658 | 828 | 758 | 174 | 30 |
| Higher education sector | | | | | | | | | |
| Total higher education sector | 653 | 802 | 836 | 817 | 877 | 960 | 1,082 | 429 | 66 |
| All sectors combined | | | | | | | | | |
| All sectors combined | 2,161 | 2,388 | 2,625 | 2,685 | 3,136 | 3,922 | 4,549 | 2,388 | 111 |

1. Figures exclude GST.

2. Sector and published industry breakdowns accord with the Organisation for Economic Co-operation and Development's (OECD) recommendations for international comparability.

Food innovation

The Manawatu region has significant strengths in food innovation. The university, CRI and business research and development organisations previously described have extensive food-related expertise.

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machinery, technology, and software that supports food innovation. These could lead to the export of intellectual property, food ingredients and products, processing equipment or software.

The strength of the region in food innovation was highlighted in a detailed comparison of R&D expenditure in 2004 by the Ministry of Research Science and Technology in its Research and Development in New Zealand: A Decade in Review report, published in 2006. While the data was only available at an institutional level rather than at a regional level, the data was still useful for an analysis of strengths in the Manawātū region. R&D surveys since 2004 have not provided a similar breakdown of expenditure. More detail on these strengths is provided in the following overviews for university and CRI research and development expenditure.



University research and development expenditure

A detailed comparison of University R&D expenditure in 2004 was prepared by the Ministry of Research Science and Technology in its Research and Development in New Zealand: A Decade in Review report. This research has not been updated since, but still provides a useful historical picture of the distribution of research expenditure by field of research. An important strength for Massey University was in industrial development R&D expenditure.

Expenditure by Massey in 2004 was 31 percent of total university industrial development R&D expenditure, just behind Auckland University, which had a 33 percent share of total expenditure in this category.

A related sector of strength for Massey University was R&D expenditure on the agriculture, forestry and fishing sector, where Massey was again ranked second. Its R&D expenditure was 34 percent of total university expenditure in this category, closely behind Lincoln's 35 percent share.

A third and related category of importance to Massey University was development of infrastructure R&D

expenditure. This expenditure category includes: commercial and trade services; urban and rural planning; transport; and information, communication, and technology software. Massey's R&D expenditure was 20 percent of total university expenditure in this category, closely behind Auckland's 22 percent share.

Since 2004 Massey University has added a Health Sciences School at its Palmerston North campus. Its research is focused on the science of promoting health, improving quality of life and our environment, and reducing health inequalities and disease for individuals, whānau and communities.



Massey at Palmerston North

The University's original campus is set on picturesque, park-like grounds across the Manawatū River from Palmerston North city. A combination of heritage buildings and purpose-built study and research facilities, the campus is at the centre of a science research and food innovation hub that includes Government-owned research organisations with close ties to Massey.

Established in 1927 as an agricultural college, today this campus plays a leading role in research and teaching for New Zealand's key agriculture and food industries. Surrounding the campus are commercially operated

farms, used for research and teaching purposes. It is also home to New Zealand's only veterinary science school and university degree-level aviation qualification.



Research Excellence at Palmerston North

Massey University is a world-leading university in many academic disciplines and fields of research. Its point of difference is its world-leading research, which is connected to community and industry. With a commitment to both applied and discovery research, this “dual focus” gives the University the ability to address both real-world and pure research problems.

Massey University has numerous research centres that enhance the University’s research and teaching capacity and provide staff and students with world-class infrastructure and support. With its historic roots in research in Palmerston North, Massey’s commitment to the city and surrounding region is evidenced in the number of research centres based in or led from this location.

Research centres at Massey University are hosted across all three campuses and, in some cases, with other organisations and industries:

Palmerston North based

- Riddet Institute New Zealand
- Food Safety Science and Research Centre
- Te Mata o Te Tau (Academy for Māori Research and Scholarship)
- Centre for Research in Mathematics Education
- Te Au Rangahau (Māori Business Research Centre)
- Farmed Landscapes Research Centre
- Massey University and Beijing Language and Culture University Joint Research Centre in Applied Linguistics
- Massey University Working Dog Centre
- Wildbase
- Animal Welfare Science and Bioethics Centre
- Centre for Organisational Excellence Research
- Infectious Disease Research Centre
- EpiCentre (veterinary epidemiology training and research)
- New Zealand Life Cycle Management Centre
- Medical Physiology Research Unit
- Equity through Education

- Centre for Structural Biology
- New Zealand Centre for Precision Agriculture
- Centre for Additive Manufacturing
- Innovative River Solutions
- New Zealand BioChar Research Centre
- Centre for Postharvest and Refrigeration Research
- Centre of Excellence in Farm Business Management
- Joint Graduate School of Horticulture and Food Enterprise
- Centre for Industrial Management and Innovation

Based across Palmerston North and Auckland

- Vitamin D Research Centre

Based across Palmerston North, Wellington and Auckland

- Center for Culture-Centered Approach to Research and Evaluation

Wellington based

- Research Centre for Hauora and Health
- Financial Education and Research Centre
- Joint Centre for Disaster Research
- Sleep/Wake Research Centre

Auckland based

- Alpha-Massey Centre for Natural Nutraceutical Research
- Centre for Metabolic Health Research
- Centre for Advanced Retail Studies
- SHORE & Whāriki Research Centre
- Centre for Mathematics in Industry
- Centre for Theoretical Chemistry and Physics
- Centre for Parallel Computing
- Nutrition and Dietetics Centre
- Beverage Lab

Based at other centres close to industry

- AL Rae Centre for Genetics and Breeding (based at Ruakura)

Enterprise at Massey

Massey University promotes collaborative arrangements, innovative research, technology transfer, and encourages links with national and international academic and research institutions and commercial organisations. Massey is committed to translating innovative academic research into commercial opportunities, through existing commercial enterprises or new ventures. The university also offers an enterprise programme to all of its students, with the goal of nurturing the spirit of entrepreneurship in all disciplines and professions.

Examples of recent enterprise successes at Massey University include:

- In 2018, Massey University’s spinout company BioLumic secured a US\$5 million (equivalent to around NZ\$6.9 million) investment for their work developing products to support food growers around the globe using ultraviolet light.

- Global food company Nestlé has acquired a novel technology developed by New Zealand scientists that will enable it to address iron deficiency. The unique technology, FERRI PRO was developed to address iron deficiency, without adversely affecting the taste of food and beverages. It was developed by Massey University researchers at the Riddet Institute Centre of Research Excellence hosted by Massey in the Manawatū.

“The technology was developed to help to address the world’s most important nutritional deficiency, with over 1.6 billion people suffering from iron deficiency anaemia,” Riddet Institute director and research team leader Distinguished Professor Harjinder Singh says.

“But our goal was to not only address iron deficiency, but address it without impacting the product quality. So, we developed a novel protein-iron complex using food-grade materials and a unique processing method. The complex has substantially superior functionality compared with other products in the market. It provides advantages over other sources of iron present in foods, including ferrous sulphate, the recognised leading iron supplement.”



Note that this is an indicative description only.

Crown Research Institute research and development expenditure

A detailed comparison of Crown Research Institute (CRI) R&D expenditure in 2004 was prepared by the Ministry of Research Science and Technology in its *Research and Development in New Zealand: A Decade in Review* report. This research has not been updated since, but still provides a useful historical picture of the distribution of research expenditure.

Four of the nine CRIs in 2004 had offices based in the Manawatu region but these CRIs were in the top five CRIs for total R&D expenditure in 2004. CRI R&D expenditure was heavily weighted towards agriculture, forestry and fishing in 2004, accounting for 39 percent of R&D expenditure in 2004, industrial development accounted for 21 percent and development of infrastructure accounted for 7 percent.

CRI R&D expenditure on agriculture, forestry and fishing was strongly concentrated in the three CRIs which have offices in the Manawatu region. AgResearch accounted for 35 percent of the total, Plant & Food Research¹ 38 percent and Manaaki Whenua – Landcare Research

12 percent. These three CRIs accounted for 85 percent of agriculture, forestry and fishing R&D expenditure.

There was also a significant share of industrial development R&D expenditure conducted by these CRIs. Plant & Food Research accounted for 36 percent of the total and AgResearch 12 percent, giving a total of 48 percent of total R&D expenditure.

Development of infrastructure R&D expenditure was strongly concentrated in Manaaki Whenua – Landcare Research, which accounted for 47 percent of total R&D expenditure in this category in 2004, while AgResearch accounted for an additional 7 percent.



¹ HortResearch and Crop & Food Research were merged in December 2008 to form Plant & Food Research

AgResearch

Leading agri-based science innovation

AgResearch is a Crown-owned research institute. It plays a key role in delivering new knowledge and technologies to support agriculture, one of New Zealand's largest export earners. Our two focus areas of research are creating smart, sustainable farming systems, and the most sought-after food and bio-products.

The Grasslands Research Centre in Palmerston North is one of four AgResearch campuses around New Zealand and the base for almost 300 of AgResearch's staff. Grasslands is located about five minutes' drive from the Palmerston North city centre, and is within 10 minutes' walk of Massey University's main campus.

AgResearch scientists also work with Massey University in a joint arrangement called the Hopkirk Research Institute, based at Massey University's Turitea campus. The Hopkirk Institute focuses on food safety, veterinary and public health research. In 2020 we opened Te Ohu Rangahau Kai, our joint food science hub with Massey University and Riddet Institute in Palmerston North. This facility is explicitly designed for collaboration, and is a key part of the Food HQ food science community in Palmerston North. We anticipate Te Ohu Rangahau Kai will significantly increase the visibility and credibility of New Zealand food science nationally and internationally.

Key research at AgResearch

Among the important research taking place at the Grasslands Research Centre is research into soil biology and improved pasture plants; and the nutrition of ruminant animals such as cattle. This includes work on endophytes – fungi that live within grasses – that have saved the New Zealand economy billions of dollars due to improvement in productivity of pasture and livestock

health, and present further opportunity for economic gains.

Te Ohu Rangahau Kai hosts a large portion of the AgResearch Food & Bio-based Products team. They create the knowledge and tools to develop high value value foods, ingredients and bio-based products, particularly from pastoral-based agriculture. Areas of expertise include dairy foods, food nutrition & health, proteins & biomaterials, food assurance and meat quality.

Scientists based at Grasslands are also studying the inner workings of livestock, such as the rumen microbiome, to learn more about their digestion and how it for example affects the emission of greenhouse gas methane from the animal. Specialised chambers at Grasslands allow for gases from the livestock to be measured, to support the development of methods to reduce animal methane emissions, alongside the New Zealand Agricultural Greenhouse Gas Research Centre and the Pastoral Greenhouse Gas Research Consortium.

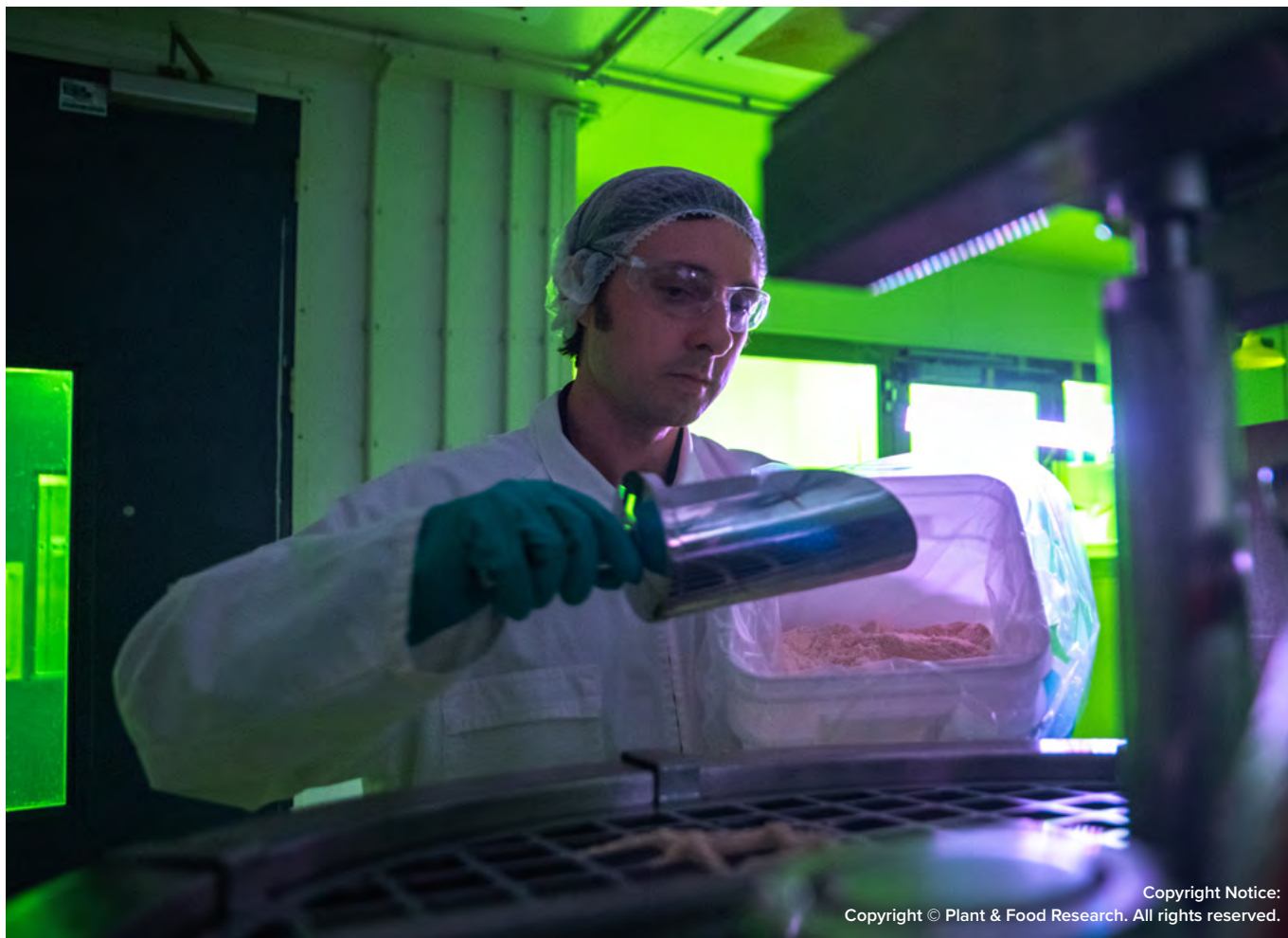
The Grasslands campus also features the Margot Forde Forage Germplasm Centre. The centre is New Zealand's national gene-bank of grassland plants and hosts the New Zealand Endangered Species Seed-bank. The centres collection includes more than 140,000 seed samples, and seeds from around 100 countries. Some



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Plant & Food Research

At Plant & Food Research, we believe science can create a better future. By finding smarter, greener options today, we're helping secure the world we want to live in tomorrow. With our partners, we use world-leading science to improve the way they grow, fish, harvest and share food. Every day, we have 1000 people working across Aotearoa New Zealand and the world to help deliver healthy foods from the world's most sustainable systems.

The company's research is applied across the value chain, to create the world's most sustainable food systems, as well as novel, nutritious foods valued by producers and consumers.

Approximately 135 of Plant & Food Research's 1,000 staff are based in Palmerston North, making it the third largest of the company's 14 New Zealand locations. The Palmerston North site has modern, purpose built facilities, including a range of specialised laboratories, fumigation

facilities, coolstores, glasshouses, a food development facility, and a state-of-the-art analytical chemistry suite.

Plant & Food Research's national and international connections ensures the right team can be built to answer customer questions. Plant & Food Research is a partner in the Riddet Institute, the New Zealand Food Safety Science and Research Centre, FoodHQ and the High-Value Nutrition National Science Challenge, and is a member of Foodvalley.

Research based in Palmerston North

Key research undertaken at Plant & Food Research's Palmerston North site includes:

Food Innovation

Plant & Food Research applies knowledge to support the preservation of harvested produce beyond the farm gate; the transformation of plant and marine bioresources into ingredient, processed food, beverage and bio-based products; and the analysis, design and presentation of products so that consumers purchase them for health and enjoyment.

This involves understanding the physiology of whole fresh foods, the components and structure of foods, and identifying health-promoting compounds. This knowledge is also applied to the development of new foods and ingredient concepts that deliver more and align with international regulations for food and health claims. The research team also has extensive knowledge in understanding consumer, producer and market drivers, to ensure any new food products meet requirements from field to plate.

Sustainable Productions Systems

Plant & Food Research undertakes research to help minimise the environmental impact of horticultural and arable production systems while optimising yield, quality and economic performance. This assists growers and exporters with meeting stringent sustainability requirements in New Zealand and overseas.

Researchers in Palmerston North collaborate with leading international research groups, environmental organisations, horticultural sector companies, industry bodies and regional councils to develop system models and decision support tools to minimise the environmental footprint of horticultural and arable production in New Zealand.

Bioprotection

Plant & Food Research develops new technologies, tools and protocols that protect the horticultural industry from pests and diseases while maintaining quality and productivity, ensuring growers and exporters maintain or gain access to global markets.

Scientists at Palmerston North specialise in the development of effective postharvest treatments for exported goods, ensuring New Zealand's international trade opportunities are maximised.

The Palmerston North site is home to New Zealand's largest disinfestation research facility which is used in the development of scientifically validated treatments for imported and exported goods, thereby playing a key role in the country's biosecurity.

New Cultivar Innovation

Plant & Food Research combines traditional breeding with modern genomics techniques to develop better cultivars, faster. This entails breeding new fruits, vegetables, arable and ornamental crops with novel characteristics that appeal to consumers and are of interest to producers; and working closely with industry partners to identify what product characteristics will have the greatest impact in important and emerging export markets.

Information and technologies developed at Palmerston North underpin breeding activities throughout New Zealand and have international application. Key research programmes include the development of specialised tissue culture and plant hybridisation techniques, gene mapping and marker identification, and understanding plant pigment development.



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Manaaki Whenua – Landcare Research

Manaaki Whenua – Landcare Research is the Crown Research Institute for our land environment. We are tasked with helping New Zealanders understand and care for our land and the rich biology that shares this land with us. Our scientists and experts study New Zealand’s biodiversity, ways to protect our land from biosecurity threats, and the sustainable use of our land resources and our changing environment. We work with government, Māori, industry, communities, individuals, and scientists from around the world to create lasting impacts for our land – because our land is our future. Tō tātou whenua, mō āpōpō.

Our Palmerston North site, the second largest of our eight sites and one of our major research locations, is based on the Massey University campus. It is home to the Environmental Chemistry lab, and work in a number of key research areas is also undertaken here.

Environmental Chemistry Lab

The Environmental Chemistry Laboratory (EC Lab) is an International Accreditation New Zealand (IANZ) accredited laboratory. Our staff are involved in commercial analytical projects as well as providing field and laboratory support for research teams within Manaaki Whenua. The laboratory offers a range of analytical services on soil, plant, and water samples to both company and external clients.

Soil research

Soil and landscape processes underpin both the productivity and health of New Zealand’s land and freshwater ecosystems. They provide ecosystem and productive services on which our primary industries and infrastructure rely, act as the platform for communities to live, work and play, as well as underpin a national identity on which our culture and tourist trade are based. Our research looks at the complex interrelationships that control the response of soils and landscapes to climatic and human-induced pressures, evaluating current risk, and offering sustainable land management and land use options.

Our current research capabilities include: soil mapping and land capability assessment; erosion and sediment





processes, soil health, biology and toxicity assessment and management; carbon storage and soil carbon, nitrogen and trace element cycling; soil water storage and movement; soil chemistry and physics laboratories, in-field sensing technologies for mapping and real-time environmental monitoring; modelling of soil processes at scales from the soil profile to the nation; and management of the nationally significant soil data repository, and S-map Online website.

Informatics

Our Informatics research applies expertise in remote sensing, geographic information systems (GIS), database application development, web services, biodiversity information management, and biometrics to provide new ways of delivering research data and information to users of research, and to our own science community. Research in Palmerston North focuses on Geospatial Informatics, for example, providing information to MfE on changes in New Zealand forest cover to meet our international Kyoto Protocol reporting responsibilities.

Greenhouse gases and climate change

Our research is improving understanding of future climate change impacts on land use suitability and adaptability, and the processes that control greenhouse gas emissions and removals from New Zealand's managed and unmanaged land-based activities. We are also developing tools to help policy makers, land managers, and landowners evaluate and prioritise land-based options for mitigating and adapting to climate change.

Results from these tools will quantify the economic, social, and environmental impacts of climate change, maximising potential benefits for New Zealand. They will also strengthen both New Zealand's ability to meet its international reporting obligations, and the economic and biophysical impacts of proposed domestic climate change policy on agriculture and the environment.



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Business research and development

Business expenditure on research and development has increased substantially from \$322 million in 2000 to \$2,407 million in 2019. The business sector has increased its share of total research and development expenditure from 30 percent in 2000 to 60 percent in 2020.

The Regional Business Partners Programme (RBP) in conjunction with Callaghan Innovation has been delivering funding for private sector R&D since 2013. From 2013 to 2015 The Factory (formerly the Bio Commerce Centre and Building Clever Companies) managed the Callaghan Innovation contract to provide co-funding for R&D activities in the private sector.

Figures up to 2015 show a slow decline in R&D activity in the region, which can be linked to a decline in the manufacturing sector. A rapid fall in global dairy prices also had an adverse effect on R&D activity over this period as it lowered farm incomes, resulting in reduced sales of agricultural machinery, equipment and services. Companies were forced to reduce or in some cases completely abandon their R&D activity.

Central Economic Development Agency (CEDA) has been managing the Callaghan Innovation programme since July 2015 and has overseen a steady increase in R&D activity, especially in the agritech and digital sectors. There has also been an increase in the level of student funding that Callaghan Innovation provides to allow companies to utilise the skills and knowledge of tertiary students. There is a range of grants to cover small R&D projects over the summer break as well as for projects that will take two to three years to complete and result in a Master's or PhD graduate. In 2016 only two companies were participating in the programme but by the end of 2020 15 companies were on board with 35 students employed throughout the region.

Current R&D grant funding of \$2 million is indicative of a private sector R&D spend of over \$5 million per annum over the Manawātū-Whanganui region. This figure is very conservative as the R&D activities of Fonterra Research Centre, with over 300 researchers, add significantly to this figure.

In 2019 the government introduced the Research and Development Tax Incentive, which allows for a 15% tax credit on eligible expenditure. The upper cap is \$120 million with a minimum of \$50,000 R&D expenditure. The scheme replaces the Growth Grant from Callaghan Innovation, which is being phased out in the 2020/21 tax year.

The COVID-19 pandemic in 2020 also prompted some extra funding sources for R&D expenditure in the private sector. Companies that had R&D activities affected by COVID-19, either through a revenue drop or services not able to be delivered, could apply for a R&D loan from Callaghan Innovation. Loans were available for up to \$400,000, with a range of repayment options to enable companies to continue their R&D projects. Callaghan Innovation also issued Booster Vouchers valued up to \$5,000 for companies to complete critical parts of their R&D projects if affected by COVID-19. The R&D Loan Scheme and Booster Voucher scheme added a further \$3.3 million of funding into the Manawatu-Whanganui region in 2020.

Sprout is an agritech & agrifood business accelerator supported by The Factory, that provides emerging start-ups with business advice, network connections and access to funding. Located at the Agritech Hub in Palmerston North, New Zealand, Sprout's activities include an annual intake of 8-12 start-ups from around the globe who join a six-month curriculum-based business accelerator. Sprout also provides investment and advisory services to agritech & agrifood companies. Sprout is supported by both public and private partners that seek to lead the future of primary industries both in New Zealand and around the world.



Fonterra Research and Development Centre

The Fonterra Research and Development Centre (FRDC) in Palmerston North is a world leader in dairy innovation and food technology, providing vital support for the co-operative's business, from its grass roots in New Zealand through to cutting-edge technology in dairy research, production and processing around the world.

The complex, across the road from Massey University, comprises more than 4000 square metres of laboratories and offices. It houses one of the globe's largest registered dairy pilot plants and its staff – numbering about 300 – are responsible for world-leading innovation that is creating exciting new products and foods that support healthy, active lifestyles in more than 140 countries.

Among the dedicated people working there are hundreds with tertiary qualifications, more than 150 post-graduates and some of the world's top dairy and nutrition scientists.

One of them, Dr Skelte Anema, was recently named as one of 18 New Zealanders to be made a Fellow of the Royal Society of New Zealand, in recognition of his world class research – a rarity for someone working in dairy research.

The FRDC and the wider co-op also draw on expertise in leading research centres around New Zealand and across the globe, which enables Fonterra to be a global leader in dairy innovation.

The facility in Palmerston North is complemented by innovation centres in key markets, such as China, Malaysia, Brazil, Chile, Australia, Sri Lanka, Indonesia and

in other centres in New Zealand, all of which aim to bring innovative new products for consumers. These centres allow Fonterra to rapidly apply technologies in-market to suit the needs of those customers.

FRDC has been a centre of great science and innovation for many decades. That work began when the New Zealand Dairy Research Institute was founded in 1927. When Fonterra Co-operative Group was formed in 2001 the NZDRI became a Fonterra subsidiary and was renamed the FRDC on June 1, 2002.

Fonterra's commitment to innovation allows the company to reduce costs and develop new food and dairy technologies in a broad range of areas, including on-farm productivity, new consumer products and ingredients, and processes to help reduce its environmental footprint.

This work has produced numerous breakthroughs that address the needs of consumers across the life stages, from infancy through to old age and for multiple eating occasions, be they in the home or when eating out.

These include patented probiotics providing health and nutritional benefits to infants and adults; Anlene™ and Annum™, providing mobility and cognition benefits; reduced fat and low salt cheeses; spreadable butter; cutting-edge mozzarella technology; and numerous

proprietary dairy proteins for use in yoghurts and dairy beverages, as well as, sports, healthy aging and medical nutrition applications.

In the food service platform, our mozzarella technology provides a step change in the manufacture of the product and allows us to adjust the taste and textural properties of the cheese to meet customer needs. Close to half of the pizzas made in China are now topped with Fonterra's mozzarella and the co-op recently announced the building of a new \$240 million mozzarella plant at Clandeboye, near Timaru, on the back of that science.

In our advanced nutrition platforms, our patented protein ingredients such as functional whey and functional milk protein concentrates enable the protein fortification of dairy beverages and yoghurts, which is meeting the

growing consumer desire for more protein whilst still providing products that have great taste and texture.

Much of that work has been highlighted in national innovation awards and through international recognition. Fonterra has won four NZ Innovators Awards in the last four years and an independent review panel comprising some of the globe's top dairy and nutrition scientists has described the co-op's food-structure science programme as one of the top three, if not the top, programme of its type in the world.

The work above and in other important projects is contributing to the growth of Fonterra's value-add business and the positive impact of that in the dairy industry and wider economy.



Fonterra Research & Development Centre
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Synlait Palmerston North

At Synlait we combine expert and sustainable farming practices with state-of-the-art manufacturing processes to produce a range of nutritional milk products that provide genuine benefits for human health and wellbeing. Our purpose Doing Milk Differently For A Healthier World **is driven by being different, essential nutrition, and sustainability. Our disruptive, innovative spirit combined with resolute determination to do the right thing for planet and people sets us apart.**

Our research and development centre is no exception. With 20 staff the team might be small, but they are delivering some impressive results. The team are Synlait's Centre of Excellence for Liquids with a focus on research and development in the liquids space. The work they do is supporting Synlait to explore new opportunities, to streamline Synlait's existing processes, optimise our plant and equipment, and to make the most of every drop of milk.

Partnering with Massey University and FoodPILOT, one of the New Zealand Food Innovation Network's four hubs, Synlait Palmerston North is located at the forefront of innovative food technology research and commercialisation in New Zealand.

Synlait's Technical and Applications Manager, Kirsty Blair, commented: "We're doing some really exciting things right now. There's so much to explore in this industry and this team certainly isn't short of ideas. But we're also really proud of some of our achievements to date."

Kirsty's team were heavily involved in the refinement of Synlait Dunsandel's Advanced Liquid Dairy Packaging Facility which supplies private label fresh milk and cream to Foodstuffs South Island. They have also been supporting the development of whipping cream which is getting a lot of interest in China.

In addition to an administration office, Synlait Palmerston North has a fully-equipped Research and Development laboratory which is well set-up for functional dairy product development. There is also a pilot scale processing plant, affectionately known as Syndi. Syndi arrived from Sweden on 17 September 2018 and is located at FoodPILOT. Syndi is designed to mimic the processing capability of Synlait Dunsandel's Advanced Liquid Dairy Packaging Facility on a much smaller scale and is used for product development, scale-up, and product improvement trials.

As well as the new product and process development work, a number of Synlait's staff support Massey's Food Technology students. The team also welcomes summer student interns each year, from universities throughout New Zealand.

"We have a Masters student and we support Massey fourth year food technology students in their final year projects. This year we have three student projects. Providing industry experience and incorporating the students into the culture of Synlait is something we take seriously," Kirsty commented.



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Biolumic

BioLumic is a biotechnology company that programmes plants with light. Creating a new agricultural paradigm where precise light treatments can be used to direct crop development, BioLumic is developing a world-changing, clean and green agtechnology in the Manawatū.

Founded in 2014 as a spinout from Massey University and The Factory, BioLumic is located on the Food HQ campus in Palmerston North. BioLumic develops Light Signal Recipes that are applied to seeds or young plants for short durations, which induce preferential genetic expression patterns, leading to increased crop yields, upregulation of plant defence against disease and pests, and beneficial regulation of crop composition, such as phytochemical concentration.

BioLumic employs a team of more than 20 in Palmerston North, and has staff and operations located in the United States. BioLumic operates across disciplines, with team

expertise in plant biology, molecular biology, engineering, software, agronomy, and electronics. BioLumic's Plant Photobiology Centre on the Food HQ campus is a world-first R&D facility, which is also licenced by the Ministry of Health for Cannabis research.

BioLumic offers yearly summer internships to undergraduates, supports postgraduate research programmes, and collaborates with a number of partners in the local innovation ecosystem. Supported by local, regional, and global investors, BioLumic was the first New Zealand agtech company to complete a Series A capital raise from overseas venture funds.



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Centres of Research Excellence, Research Institutes, Research Associations and Innovation Centres

The standard classification for research and development activity based on the business, government and higher education (university) sectors has hidden the growth of collaborative research arrangements in the Manawatū region through a range of different institutions, which include a Centre of Research Excellence, Research Institutes, Research Associations and Innovation Centres.

Many of these collaborative organisations do not appear in the Statistics New Zealand Business Frame database as separate economic entities. This is because the buildings and facilities are usually owned by one of the partners to the collaborative organisations and the staff remain employees of the partner organisations

but are able to work together on collaborative projects. The activity of the organisations is still measured but is identified as being either undertaken by a university, a CRI or business organisation.



FoodHQ

FoodHQ is where science meets food. It is a collaborative initiative that brings together New Zealand's smartest food science minds to drive innovation in the food industry.

The Riddet Institute

Partners: Massey University (host), AgResearch, Plant & Food Research, University of Auckland, University of Otago.

The Riddet Institute is a premier national centre for fundamental and strategic scientific research in food.

Its area of expertise is at the intersection of food material science, gastrointestinal biology and human nutrition.

The Institute is engaged in discovery-based scientific research into foods and human nutrition, particularly "future foods in harmony with nature".

Hopkirk Research Institute

A collaborative venture between AgResearch and Massey University to create a team of animal health researchers of a size and expertise to rival that anywhere in the world.

New Zealand Food Safety Science and Research Centre

Brings together seven research partners to form a national, virtual, scientific network jointly funded by the New Zealand Government and industry. The scientific collaboration is aimed at protecting and enhancing New Zealand's \$50 billion plus food sector, and to protect the health of children and families who consume New Zealand food products.

New Zealand Leather and Shoe Research Association (LASRA)

The organisation is funded by industry subscriptions, government contracts and a range of private contract and testing services. LASRA has a preferred partnership arrangement with Massey University.

The FoodPilot – part of New Zealand Food Innovation Network (NZFIN)

NZFIN is a national network of facilities supporting the food and beverage Industry in its innovation. Each of the four regional centres has a different focus reflecting its local businesses. They are complementary. Three have equipment sized to support first manufacture of new food products. But the FoodPilot is sized for research and development and is stationed in the heart of Massey University & FoodHQ. It is open to all sectors of the food industry offering product and process development capability to test processing, performance and appeal of new products before they migrate to larger-scale processing plants within NZFIN or elsewhere.

The Factory

The Factory is a team of curious individuals that thrive to support entrepreneurs, founders, start-ups and companies. They are a business development, training and innovation hub located in Palmerston North on Dairy Farm Road that works regionally, nationally and internationally.

Sprout Agritech

Sprout is an AgTech & FoodTech business accelerator and investment company supported by Finstere, OurCrowd, Fonterra and The Factory. Sprout provides emerging start-ups with business advice, network connections and access to funding. Located at the Agritech Hub in Palmerston North, New Zealand, Sprout's activities include a twice a year intake of 8-12 start-ups from around the globe who join a 3-month curriculum-based accelerator. Sprout also provides investment and advisory services to AgTech & FoodTech companies. Sprout is supported by both public and private partners that seek to lead the future of the Food & Fibre sector both in New Zealand and around the world.



FoodHQ

FoodHQ is an independent, not-for-profit collaboration that brings together New Zealand's smartest food minds to drive innovation in the food industry. It is headquartered in Manawatū due to the critical mass of food science and innovation capability located here, but works nationally and internationally to connect and facilitate.

It is a challenging and exciting time for the global food industry as evolving customer demands and new technologies create huge opportunities to reinvent our food production future. To succeed at this, New Zealand researchers, entrepreneurs, food producers, growers and manufacturers need to innovate and collaborate.

FoodHQ aims to bring different people and organisations together and help make things happen. It can facilitate introductions and connections to accelerate the development of ideas and capturing of more value. It works to improve the collaboration between research and commercial interests, make it easier for businesses to access the right facilities and expertise to address their needs.

Much of FoodHQ's more recent focus has been on New Zealand's nascent emerging proteins sector. It formed Emerging Proteins NZ (emergingproteins.co.nz),

a virtual network bringing together those from across the value chain who are working on plant, insect, fungi, algae and biotechnology-based protein production. This has provided much needed coordination, and FoodHQ is working closely with industry, researchers and government to identify initiatives to accelerate the development of the sector.

FoodHQ Partners include public and private sector research, education and industry organisations, including AgResearch, Fonterra, Massey University, Plant & Food Research, Sprout Agritech, the Riddet Institute, the New Zealand Food Innovation Network, the New Zealand Food Safety Science and Research Centre, B.linc, Cawthron Institute, ESR and Pūhoro STEM Academy. Collectively, these organisations have approximately 2,500 researchers involved in food science and innovation activities, most of whom are based Manawatū.

food **HQ**
Where food ideas meet science

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The Riddet Institute

The Riddet Institute is a premier centre for fundamental and strategic scientific research. Its area of expertise is at the intersection of food material science, novel food processing, human nutrition and gastrointestinal biology. The Riddet Institute's environment for discovery and learning is fertile ground for building research capacity. Its students of today will be the leaders of a prosperous food industry in the future, one that develops innovative, sustainable, healthier foods.

The Institute has five main partners (Massey University is the host institution, the University of Otago, the University of Auckland, AgResearch and Plant & Food Research) and is led by Distinguished Professor Harjinder Singh, winner of the Prime Minister's Science Prize in 2012. Massey University's Manawatū campus is a hub of agrifood research in New Zealand and an ideal base for the Riddet Institute national headquarters. Our headquarters can now be found within Te Ohu Rangahau Kai – a new collaborative community of food researchers. This state of the art AgResearch-Massey University research facility houses New Zealand's largest collection of food research scientists and is a very significant investment in future collaboration, with its ease of access to other researchers and industry partners in the area.

The Riddet Institute is one of ten Centres of Research Excellence funded by the Government, bringing together New Zealand's leading scientists in food and nutrition in a collaborative, multidisciplinary national and international network. The funding for the institute was renewed in 2020 for a further eight years. The Riddet Institute also has many government funded programmes in collaboration with its partners, including the High Value Nutrition National Science Challenge and other Ministry of Business, Innovation and Employment funded research.

Institute quick facts*:

- The Riddet Institute has published 1600 peer-reviewed journal papers
- More than 160 postgraduate students have graduated with a doctorate

* Data as of June 2021

- The Institute secured \$95 million in research funding, \$30 million from industry
- Our patented invention FerriPro™ was sold to global food company Nestlé in 2019 and is the biggest commercialisation deal in Massey University history. This technology will help address global iron deficiency and was winner of the 2020 PwC Commercial Impact Award from KiwiNet
- Our students come from over 37 different countries, leading to a unique multi-cultural environment. 60% of our graduates find employment in New Zealand and 83% are employed within research or industry
- We have hosted 9 national agrifood summits and 7 international conferences on food and related topics and how they impact New Zealand



Distinguished Professor Harjinder Singh



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Te Ohu Rangahau Kai
- a collaborative community of food researchers from AgResearch, Massey University and the Riddet Institute



Hopkirk Research Institute

Hopkirk Research Institute

The Hopkirk Research Institute is focused on achieving and promoting scientific and technological excellence in areas relevant to food safety, animal and public health. In particular the work has an emphasis on infectious zoonotic diseases endemic to New Zealand which may threaten the livelihood of the pastoral sector and health of New Zealanders.

The \$17m state-of-the-art Hopkirk Research Institute was opened in March 2007. Scientists enjoy award-winning, architecturally-designed surroundings that allow the assimilation of skills, expertise and knowledge of AgResearch's food microbiologists, immunologists and parasitologists with Massey University's clinicians, epidemiologists and pathologists.

Built on the Palmerston North Campus of Massey University, the Hopkirk Research Institute offers nearly 4,000 sqm of laboratory space, and can house approximately 70 research staff. The Institute also hosts the New Zealand Food Safety Science and Research Centre, the New Zealand/China Food Protection Network, Massey's mEpiLab and the TB Diagnostic Laboratory.

Researchers at the Institute work collaboratively on many different projects ranging from Anti-Microbial Resistance to development of vaccines for animal diseases.

AgResearch's Food Assurance Team's research is aimed at addressing industry needs across the whole value chain from rumen to retail. This approach involves every stage of food production from on-farm to food consumption. That includes food microbiology, food safety, product quality, processing technology, packaging, refrigeration and transportation, social or religious requirement (such as Halal), as well as identifying ways of measuring quality and authentication of products for export and domestic markets.

AgResearch's Animal Health Team is investigating ways to mitigate methane emissions in ruminants, vaccines for ovine pneumonia and diagnostics for bovine tuberculosis.

Massey's mEpiLab research area covers epidemiology, evolution and control of agents of infectious disease and contributed to major reductions in the rates of foodborne disease in New Zealand. The team comprises scientists with expertise in the fields of epidemiology, microbiology, molecular biology, bioinformatics/computational biology, mathematical modelling, veterinary science and public health. The Hopkirk Institute supports the Government's surveillance preparedness and management of disease events eg: the campylobacter outbreak in Hawkes Bay and provided laboratory space and technical assistance for COVID-19 testing at the facility.

The laboratory facilities include PC2 and PC3 containment laboratories, and PCR suites. These suites have both real-time and conventional PCR machines used for speciation and multilocus genotyping, and advanced technologies, such as next generation sequencing, phenotypic arrays and flow cytology. They also allow scientists to carry out specialist microbiological culture work, including aerophilic and microaerophilic workstations and tissue culture suites for infectivity assays.



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New Zealand Food Safety Science and Research Centre

The New Zealand Food Safety Science & Research Centre (NZFSSRC) was launched in 2016 and brings together seven research partners to form a national, virtual, scientific network jointly funded by the New Zealand Government and Industry. The scientific collaboration is aimed at protecting and enhancing New Zealand's \$50 billion plus food sector, and to protect the health of children and families who consume New Zealand food products.

The NZFSSRC's research partners are Crown Research Institutes AgResearch, ESR and Plant & Food Research Limited, the Cawthron Institute, a private research institute, and three Universities; Massey University (Host), The University of Auckland and the University of Otago. The Centre's Governance Board is chaired by (retired or former) biotechnologist and chemical engineer, Dr Kevin Marshall. The NZFSSRC's investors are the Dairy Companies Association of New Zealand, the Meat Industry Association of New Zealand, Zespri International, and the New Zealand Government; Ministry of Business, Innovation, & Employment and the Ministry for Primary Industries.

The Centre's role is to promote, co-ordinate, and deliver food safety science and research for all of New Zealand, where, according to the Investors Guide to the New Zealand Food and Beverage Industry report issued in November 2016, the top 100 food and beverage firms collectively generate annual revenue of \$51 billion.

The NZFSSRC takes a systems approach to food safety science and research, working across entire supply and value chains from farm to fork. A significant number of research projects have been undertaken covering the breadth of food safety related issues including traceability and provenance of food products, development of smart

technologies for detection and mitigation of pathogens, understanding and mitigating the impact of chemical residues and hazards and understanding the perceptions and preferences of consumers.

The NZFSSRC has been successful in identifying food safety science and capability nationally, resulting in a web-based, searchable database that is being used as an exemplar for other agencies across the country.

Since its establishment the NZFSSRC has also secured \$1.25 million in funding for the New Zealand-China Food Protection Network (NZ-CFPN), one of three China Research Collaboration Centres funded by the New Zealand Government (www.crcnz.org.nz). The NZ-CFPN is hosted by Massey University and involved nine research collaborators focused on strengthening collaboration between New Zealand and China in the area of food safety and security.



New Zealand
**FOOD SAFETY SCIENCE
& RESEARCH CENTRE**

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New Zealand Leather and Shoe Research Association (LASRA)

New Zealand Leather & Shoe Research Association (LASRA) LASRA is an Incorporated Society, owned by its industry clients who process 100% of New Zealand's hides and deerskins and over 90% of its lamb and sheepskins, mostly for export, providing around \$400M p.a. in export earnings to NZ Inc. It provides research, technology, and consultancy and training services to the hide, skin and leather exporting industry, the footwear manufacturing industry and a number of other related producers.

LASRA began life in 1928 as a section of the DSIR and was sited at Gracefield. It became an incorporated body in 1949. In 1973 LASRA moved into new, purpose built facilities in Palmerston North. LASRA's unique blend of expertise and experience in leather science and technology has made the organisation the Southern Hemisphere's premier research, technology and training provider for the hide and skin processing and leather and footwear manufacturing industries. New Zealand is a key player in the global leather industry. LASRA is the international leader in ovine leather research, reflecting New Zealand's dominant position as a supplier of some 10% of the material used in global leather garment manufacture. LASRA research also underpins the country's hide leather exports to countries like Italy where the final artistic touches are applied. Research from this Palmerston North institute has contributed to New Zealand's position as the leading supplier of deerskin leathers to high fashion houses such as Prada, Gucci, Hugo Boss, Mont Blanc and Ralph Lauren. LASRA is the leading Southern Hemisphere provider of testing services for safety footwear. We house testing facilities that are shared by only a handful of other institutes around the world, such as equipment for testing footwear and clothing for chain saw resistance and apparatus for testing fire fighters footwear.

LASRA enjoys a strong partnership arrangement with Massey University. The research relationship has made ground-breaking discoveries, using advanced tools such as the Australian Synchrotron, that are especially relevant

to New Zealand's hides and skins, under investment and encouragement from the Ministry of Business, Innovation and Employment. Our testing laboratories operate to ISO/IEC 17025.

We're accredited by IANZ (International Accreditation New Zealand), a signatory to ILAC's Mutual Recognition Agreement with counterpart authorities in nearly a hundred economies, which gives international recognition to LASRA test results in countries such as the USA, UK, Germany and Japan. LASRA represents NZ on technical committees developing international standards for leather testing. We carry out technical evaluations and arbitration work for exporting companies and help them resolve market access issues that arise with our trading partners in places like India, the EU and China.



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New Zealand Food Innovation Network (NZFIN)

The FoodPilot is one of four physical elements of the New Zealand Food Innovation Network. It is the place companies come to make 10 to 500 kg of some new food product. Then those companies can go to the FoodBowl in Auckland or FoodWaikato in Hamilton or FoodSouth in Christchurch to make batches large enough to sell to measure market response or to make profits.

The FoodPilot centres on a modern 1800 m² pilot plant building housing a huge collection of food process equipment housed amongst chillers, freezers, and storerooms. It carries the registrations to make product for sale or consumption in New Zealand or for export. Supporting the FoodPilot is every shade of laboratory and food scientist. And it has a fully equipped 200 L microbrewery.

The FoodPilot has on tap all that is needed for sensory and consumer insighting work, for shelf-life trials and for nutritional testing. Making it all happen is a dedicated staff of specialists.

The biggest users of the FoodPilot today are companies undertaking product development, followed by an army of PhD students with their food process research and followed by undergraduate food technologists – the food pioneers of tomorrow.

Today's FoodPilot belongs to everyone. It is open-access. Run by Massey University it is part of both the Food Innovation Network and of FoodHQ. It is the second home of staff from the Riddet Institute, AgResearch and Synlait not to mention some from Plant & Food Research, Fonterra, and other New Zealand food companies.

It is the Food Innovation Network that ties the FoodPilot in Palmerston North to the larger scale facilities elsewhere. The network can ensure companies are migrated to the most apt facility when they need to make larger quantities for market testing or commercial sale.

The Massey Microbrewery

In 2007 Massey built a microbrewery. It has a 200 L brew house servicing a suite of ten 200L unitanks for fermentation and maturation. Since then Massey has periodically run its 4-day residential brewing course and twice yearly its 2-day brewing short course.

The brewery is open-access and is well used by brewers perfecting new brews for initial sale. They take away kegs to prove they can achieve repeat sales through taps they can access – and then they are off to a contract brewer to move up to 2-5,000 L batches. This puts them in business for the cost of only a little working capital and a bit of sweat.

The brewery is now well embedded into multiple undergraduate courses – a great way to learn the science, engineering and business of modern craft brewing. And for one student masterbrewer each year it can be a pathway to a dream career.

**New Zealand
Food
Innovation
Network**

New Zealand Food Innovation Network (NZFIN)

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The Factory

The Factory are experts at getting ideas off the ground, launching start-ups, and helping businesses grow. They've worked with and supported over 10,000 founders. Launched in 2003, The Factory incubation process supports entrepreneurs and founders get there businesses started and thriving.

The Factory is a team of curious individuals that thrive to support entrepreneurs, founders, start-ups and companies. They are a business development, training and innovation hub located in Palmerston North on Dairy Farm Road that works regionally, nationally and internationally.

The Factory helps individuals, start-ups and companies with new ideas begin the process of scaling and becoming contributors to our communities. The Factory is a world leader in business acceleration and are specialists in agritech, agrifood and new technologies.

Their expertise working with founders, start-ups and business owners runs deep, having been established almost two decades ago, being a Callaghan Innovation Founder Incubator that's supported over 10,000 entrepreneurs and start-ups. In addition, The Factory owns and manages Manawatu Investment Group who collectively have invested more than \$50 million into local and national companies.



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Sprout Agritech

Sprout Agritech, a Palmerston North based agritech business accelerator, is one of four partners in Callaghan Innovations' 'technology incubator' programme. The technology incubators are designed to share connections and expertise to help new companies build up to competing internationally, and provide funding in the crucial early stages of development.

Sprout can make seed investments of \$1m in up to 40 fledgling companies. \$250,000 of the investment comes from Sprout's Limited partners, Finistere Ventures, OurCrowd, and Fonterra, and \$750,000 from Callaghan Innovation.

Scentian Bio is Sprout's first of 40 investments planned in agritech and foodtech start-ups over the next seven years.

Dr Andrew Kralicek spent the past 19 years at Plant & Food Research determining how smell receptors in insects work. These receptors are the result of 400 million years of evolution and enable insects to easily find mates, detect predators, find food, or where to lay eggs with their receptors. Kralicek's team investigated whether insect smell receptors could be combined with electronics to create an "insect nose/tongue". A new

technology developed from this research is the basis of new company Scentian Bio.

"We know this technology detects volatile organic chemicals which is the basis of a completely new sensor technology. We discovered that no one else can do this," explains Dr Kralicek. "This is deep tech, hard-core science that will have a massive impact as we have developed a tool to detect and analyse complex aroma and taste profiles. That means that we could use the technology to detect variation in water, wine or food quality for example, or even detect the presence of disease in humans."

Andrew went through Sprout Agritech's Accelerator to understand how to commercialise this discovery, which highlighted the need for connected capital to be able to establish this world-leading technology.



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Estimating the economic benefits of the research and development sector to the Manawatū region economy

Estimated direct economic benefits

Estimating the wider economic benefits of the research and development sector to the Manawatū region is difficult because of the lack of any comprehensive survey data for R&D activity in the region.

Statistics New Zealand employment data is collected using the Australian and New Zealand Standard Industrial Classification (ANZSIC06), which classifies every institution by its primary activity. Institutions engaged in similar productive activities are grouped together but problems occur when an institution engages in several activities. This is particularly an issue for research and development, since it is carried out by a wide range of institutions but is not the primary activity of the institutions. For example, R&D is a significant output for Massey University but the primary activity for the university is education, so all of its staff are classified in the “Higher Education” ANZSIC code.

The following estimates for 2020 are based on the Statistics New Zealand Research, Science and

Technology 2020 survey, Statistics New Zealand annual employee counts for scientific research organisations and data provided by Massey University.

These estimates only cover the paid staff employed by research institutions and not the post-graduate research students enrolled at the Massey University Palmerston North campus. The income of these students from scholarships and allowances is additional to the salary and wage estimates below.

The concentration of research expertise within the city is demonstrated by annual employment data published by Statistics New Zealand, which shows that Palmerston North has the second highest number of people employed in dedicated research organisations, second only to Auckland. These figures cover research across all discipline areas, and data from the public sector research organisations show more food related researchers are located in Palmerston North than Auckland.

| | Manawatū region \$ (million) | New Zealand \$ (million) |
|---|---------------------------------|-----------------------------|
| Business expenditure on R&D | 61 | 2,709 |
| Higher education R&D | 89 | 1,082 |
| Crown research institute and other government institutions | 38 | 758 |
| Total estimated R&D expenditure | 188 | 4,549 |
| Estimated total salaries and wages for R&D employees | 99 | 2,387 |
| | Employee count | Employee count |
| Number of employees | 2,500 | 70,000 |

Source: Statistics New Zealand and Massey University

Economic benefits from commercialisation of R&D

Economic benefits also occur in the city and broader Manawatū region from the commercialisation of knowledge from research and development activities. The commercialisation of knowledge is more likely to be based on knowledge developed from R&D conducted in the city but is not solely dependent on locally sourced knowledge. Location linkages are obvious from the strength the city has in the agricultural machinery and equipment manufacturing sector. In 2020 there were around nine manufacturing business units producing

agriculture machinery and equipment, employing 220 people in the Manawatū region, 10 percent of national employment in the sector.

The broader Manawatū-Whanganui region experienced strong growth in food processing sector employment between 2000 and 2020. Total employment in the sector increased by 1,600 jobs between 2000 and 2020, a 41 percent increase. National employment in the sector increased by 19 percent over this period. In 2020 the region accounted for 7.0 percent of the national food processing sector labour force and 5.0 percent of the national population.



