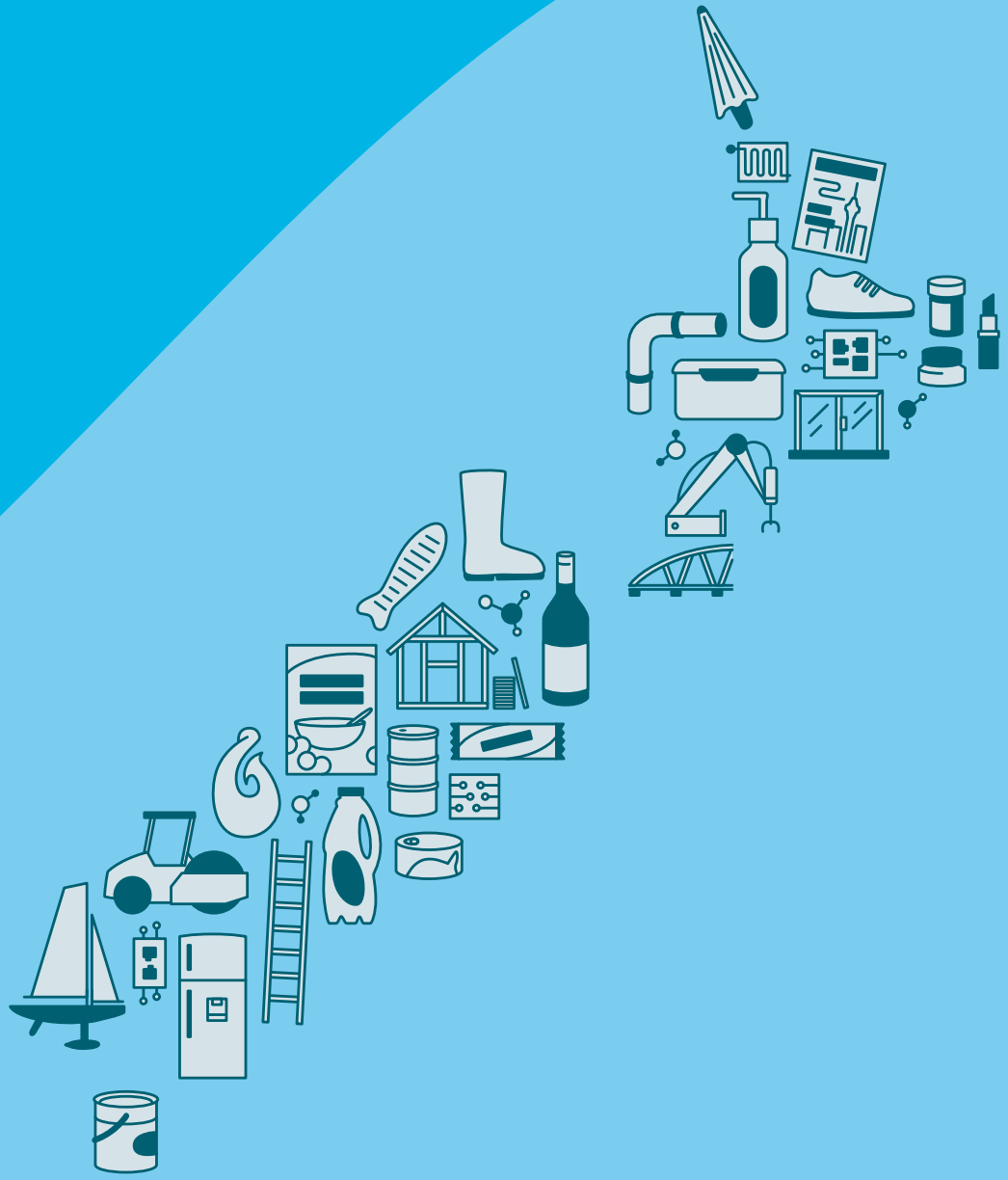
MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

NEW ZEALAND SECTORS REPORT SERIES

Beyond commodities: Manufacturing into the future



New Zealand Government

ISBN 978-1-98-853508-1 (print)
ISBN 978-1-98-853509-8 (online)

Minister's foreword

As Minister for Economic Development, it is my pleasure to present the New Zealand Manufacturing Sector Report 2018.

This report provides a comprehensive picture of New Zealand's total manufacturing sector, bringing together key facts and figures, commentary and insights from industry stakeholders, as well as findings from research.

The resulting story is a broadly positive one. After a tough few years following the Global Financial Crisis, New Zealand manufacturers have found their feet and their place in the international market. It's great to see the new and inventive manufacturing firms that have emerged and enjoyed success in recent years. They are continuing a legacy of innovation established by our pioneering manufacturers.

The manufacturing sector is a diverse, innovative and vitally important part of our economy. Today it makes up 12% of New Zealand's economy, directly employs more than 240,000 people and accounts for over half of our total exports. It is one of the main ways that we add value to our agricultural products, allowing higher value land use with lower environmental impacts. Many of our service industries exist to service the manufacturing sector. Manufacturing is also a key contributor to our regional economies, bringing employment and investment.

Manufacturing has one of the highest proportions of spending on research and development in the private sector. We can build from this strong position and do more to encourage additional R&D spending. This will foster innovations that make us more productive and competitive internationally.

The report also covers some significant issues. The manufacturing sector's continued lack of productivity growth remains troubling and limits opportunities for development. Additionally, a lack of suitably skilled tradespeople may be hindering growth. The Government and industry must encourage and value trades and technicians. That means more focus on their training, and on the parts of the economy where those skills are gainfully employed. The Government is committed to addressing these issues.

Manufacturing in New Zealand faces challenges. We are a small economy, distant from international markets. It is not generally possible for New Zealand manufacturers to compete on price with the industrial powerhouses of the world, which have advantages of scale and proximity to key markets. New Zealand firms therefore compete through the high quality and reliability of their products, the innovation and creativity in their design, the excellence of their service offering and the intelligent targeting of valuable niche markets. It is important that we actively encourage investment in both human and financial capital into these innovative, high-value industries. Continued growth of high-value manufactured exports will help to diversify the economy.

The report highlights several key trends. The future of manufacturing will be increasingly digitised and automated as Industry 4.0 technologies become more common. Manufacturers are also increasingly wrapping their products in a range of value-adding services to create a competitive edge in the market.

The most important trend highlighted is the move beyond commodities into value-added goods, differentiated through innovation, quality, brand and service.

A thriving, diverse, high-value manufacturing sector will help us to address issues such as labour productivity, low capital investment into productive parts of the economy, and environmental challenges. I look forward to working closely with manufacturers and thank them for their efforts.

Hon David Parker
Minister for Economic Development

Report objective

The New Zealand Sectors Report Series provides a factual source of information in an accessible way on key sectors that make up the New Zealand economy. The reports have been published since 2013 and are available from www.mbie.govt.nz.

This report is the first New Zealand Manufacturing Sector report. It provides information on the total manufacturing sector in New Zealand, with a focus on key trends and issues affecting each of the seven manufacturing subsectors.

The aim is to provide a comprehensive report on the state of New Zealand's manufacturing sector for the industry, policy makers, media commentators, economists, academics, students and anyone with an interest in New Zealand's economic development.

MBIE welcomes comment and feedback on this report, and on the measures the government is taking to facilitate the development of a competitive and successful manufacturing sector.

Email: sectors.reports@mbie.govt.nz

Acknowledgements

The Ministry of Business, Innovation and Employment (MBIE) would like to thank the manufacturing firms and industry bodies that gave generously of their time and knowledge to contribute to this report.

We would also like to acknowledge: Professor Gary Hawke, Tim Morris and Virginia Wilkinson of Coriolis Research Ltd, Greg Shanahan and the Technology Investment Network (TIN) team, Thomas Thwaites, Daniel Baigent, Paul Conway, Gary Hook, Ken Sowman, Jon Tanner, Dieter Adam, New Zealand Trade and Enterprise, Callaghan Innovation, Statistics New Zealand, Tertiary Education Commission, and the Ministry of Foreign Affairs and Trade.

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Manufacturing in New Zealand: Key facts

Important contributor to GDP

The manufacturing sector contributed 12% ($23 billion) of NZ's total GDP in 2017. However, this share has decreased from 14% in 2007

Productivity growth trailing

The manufacturing sector had annual labour productivity growth of 0.2% from 2005–2015, well below the NZ average of 1.0%

Large employer

The manufacturing sector employed 241,100 people in 2017 (11% of total employment), an increase from 223,500 in 2013

Key subsector – 'food and beverage'

'Food and Beverage' contributed 32% of manufacturing's GDP in 2017 and 71% of manufactured goods exports in 2017

Internationally connected

Manufacturing firms have higher rates of foreign investment and outward investment than the NZ average

High salaries, but long hours

Manufacturing employees earn an average of $63,000 per annum, 15% higher than the NZ average. However, they work the highest average hours per week to earn it

Big R&D spender

Manufacturing firms are twice as likely to invest in R&D as the average NZ firm and spent $671m on R&D in 2016

Bulk of New Zealand's exports

Manufactured goods exports earned $36b in year end June 2017, making up over half of NZ's exports

Executive summary

Manufacturing is any process that changes raw materials, substances or components into new products

The defining characteristic of manufacturing is transformation of materials. This can happen in a variety of ways across a highly diverse range of products. For the purposes of this report manufacturing is divided into seven subsectors: 'food and beverage', 'wood and paper', 'machinery and equipment', 'chemicals and refining', 'plastics and rubber', 'metals' and 'other manufacturing'.

Manufacturing is a critical part of New Zealand's economy

The manufacturing sector is diverse and dynamic and has undergone a major transition over the last thirty years, moving away from commodities towards more value-added products.

In 2017, manufacturing accounted for 12% of New Zealand's real GDP ($23 billion) and generated an estimated $36 billion in exports.

A large part of manufacturing in New Zealand – as is the case in most developed economies – is focused on the production of low and medium-low technology goods e.g. food and beverage products, metal products, textiles, plastics, paper, lumber and building materials.

Low and medium-low technology manufacturing are engines of growth

As well as making products that are in high demand, these industries create demand for inputs from a range of other innovative and knowledge intensive sectors e.g. information and communications technologies; sophisticated machinery and equipment used in production; and design and branding for fast moving consumer goods.

The production of high technology (highly engineered and science based) products, such as electronics, health technologies and pharmaceuticals, is a smaller component of manufacturing overall. New Zealand's high technology sector is smaller than that in most OECD countries, but it is R&D and export intensive.

New Zealand's size and distance have shaped manufacturing's development

Historically, our geographic isolation and small population have defined manufacturing opportunities and development. However, globalisation and technological advances have significantly changed the structure of manufacturing in New Zealand, expanding the scale and potential of some industries, while causing others to decline or shift offshore.

Manufacturing is a declining proportion of the New Zealand economy

This is an international trend. For decades, manufacturing has been declining as a share of developed economies as the proportion of services has increased. However, manufacturing remains an irreplaceable source of employment, exports, growth and innovation.

One of the most important influences on the manufacturing sector over the last decade is the lingering impact of the Global Financial Crisis (GFC). The GFC caused a decline in almost all metrics across most manufacturing subsectors. In many cases measurements have yet to recover to pre-GFC levels.

Manufacturing has experienced low productivity

Average manufacturing productivity growth has been only 0.2% per annum over the last 10 years, well below the New Zealand average of 1.0% (which is also low by international comparison). Low levels of productivity growth may be partially explained by the small New Zealand market and geographic isolation, which restricts larger scale and more efficient production.

Manufacturing is a major employer, especially outside our main centres

The manufacturing sector accounts for 4% of firms (21,366) and 11% of employment (241,100 people) in New Zealand. Firm numbers and employment both fell significantly in the years following the GFC to a low of 20,664 and 223,500 respectively in 2013.

Auckland is the largest region for manufacturing; it accounts for over one third of both firms and employment.

However, for economies outside of main population centres, manufacturing generally makes up a higher proportion of the total workforce than in larger cities. Regions such as Taranaki (17 % of employment) and Marlborough (15%) are more dependent on manufacturing than Auckland (10%) or Wellington (5%).

There is high demand for tradespeople in the manufacturing sector

At $63,228, average manufacturing annual wages are 15% higher than the New Zealand average ($54,749). However, this is partially driven by employees in the manufacturing sector working more hours per week than employees in other sectors.

The sector employs 33% more tradespeople than the New Zealand average and finds trade related vacancies the hardest to fill.

The number of graduates, trainees and apprentices in manufacturing related fields has increased since 2011, with an annual growth rate of 6% for graduates and 5% for trainees and apprentices.

The number of work visas for manufacturing related occupations has more than doubled in five years, from 4,187 in 2011 to 9,469 in 2016. Over 60% of these work visas were provided for technician and trade worker jobs.

Manufacturing is a key driver of innovation and R&D

Manufacturing accounted for 42% of New Zealand's business expenditure on research and development (BERD) in 2016. Manufacturing BERD has increased 5.4% year on year since 2008, driven by 'machinery and equipment'.

'Chemicals and refining', 'plastics and rubber', 'food and beverage' and 'machinery and equipment' manufacturing subsectors stand out for the high percentage of firms undertaking both innovation and R&D. Innovation can occur across processes, design, and marketing as well as new products.

Manufacturing is a major source of exports

In 2017, New Zealand's manufactured goods exports were worth $36 billion. This was over half of New Zealand's total exports and over three-quarters of exported goods. 'Food and beverage' exports were $26 billion, or 71% of all manufactured goods. Manufactured goods exports have increased by 3% year on year in the last decade, driven by increases in 'food and beverage' and 'chemicals and refining'; all other subsectors declined over this time.

New Zealand consistently imports more manufactured goods than it exports.

Manufacturing firms are more internationally connected than average New Zealand firms, with higher levels of both foreign investment and outward investment. 'Machinery and equipment' is the only manufacturing subsector that has more outward investment than foreign investment.

Financial performance is solid

Revenue has increased across all manufacturing subsectors in the last five years. Growth has been particularly strong (2.9% year on year) in the 'machinery and equipment' subsector.

In 2016, 39% of manufacturing firms reported investment in expansion, above the national average of 30%.

Manufacturing is moving to increased value

New Zealand manufacturing has restructured significantly over the last thirty years. Production of some goods has declined or stopped, while new industries have emerged. The shift to value is a key trend. This is underpinned by innovation and entrepreneurship, informed by increased international engagement, and driven by competitive pressures and changing global economics. New Zealand now has a substantial cohort of high growth manufacturing firms operating in a diverse range of industries.

New capabilities and an evolving ecosystem support this shift

Both private and public sector players have worked to develop the institutions and capabilities in the economy that are required to support high innovation and/or high R&D intensive firms. Governments have actively focused on this since the early 2000s.

The 'S' curve of industry development takes a long time

The development of a new industry typically follows an 'S' curve, similar to the stages a new technology goes through as it diffuses through society. There is usually a long gestation period – perhaps 10–20 years – while the skills and capabilities needed to succeed are learned and acquired by: firms; investors and service providers (accountants, bankers, lawyers); and the education and government sectors. New institutions may need to be established, or existing institutions modified.

Market trends show opportunities in 'food and beverage' and other subsectors

The market is clearly indicating that it sees significant opportunities in New Zealand's 'food and beverage', 'machinery and equipment' and 'chemicals and refining' subsectors. These industries are attracting investment, and are the sectors that have grown firm numbers, employment, innovation rates and research and development in the last ten years. 'Chemicals and refining' appears to be driven by pharmaceuticals, cosmetics and skincare.

Key themes

Theme	Description	Industry experience
Firms are avoiding 'me too' products and focusing on global niches, short runs and bespoke manufacturing	What is a small market for an international firm can be a large one for a New Zealand manufacturer, with some successfully dominating global niches. Examples include: Enatel (power solutions), South Fence Machinery (fence machinery), Buckley Systems (electromagnets). New Zealand's small domestic market means that customers can require very short runs or bespoke solutions that may be inefficient for large-scale international manufacturers to produce.	"If you are going to be a manufacturer in New Zealand you've got to be a jack-of-all-trades. . .you need to be more flexible by having a mindset about how to make your processes smarter and more efficient and understanding what adds value to your customer." – Senior executive, 'other manufacturing' firm
Competing on scale and price from New Zealand is challenging	Countries that are closer to markets, or have cheaper labour, can mass produce goods much more cheaply than New Zealand. Transporting goods within and from New Zealand is expensive. New Zealand manufacturers (with the exception of meat and dairy industries which can operate and export at scale) therefore usually need to produce high value, innovative products or target a niche that large international companies consider too small.	"I think New Zealanders typically do tend to innovate with how they do things because we can't compete on price." – Founder, 'chemicals and refining' firm
New Zealand firms manufacture offshore for a variety of reasons	It can make sense for New Zealand manufacturers to manufacture some, or all, of their product offshore. This can make it cheaper to produce and gain scale, provide access to a wider range of capabilities and allow closer production to markets.	"Retailers will not budge on their margin expectation despite what's happening in the retail sector and so I suppose we didn't have a choice but to shift to a place that we could make the [product] for less money." – Chief executive, 'other manufacturing' firm
Research and development (R&D) and continual innovation are essential to survive	Manufacturing firms are twice as likely to invest in R&D (19% of firms in 2015) as the New Zealand average (9% of firms in 2015). Spend on R&D by manufacturing firms grew by 5.4% per year from 2008 to 2016 to reach $671 million – 42% of total New Zealand business expenditure on R&D (BERD). Manufacturing firms innovate through new and adjusted plant, processes and inventory management, as well as products.	"If we didn't keep innovations coming out we couldn't stay here. We couldn't stay alive in New Zealand." – Founder, 'other manufacturing' firm

Key themes

Theme	Description	Industry experience
Digitisation and automation are increasing	Digitisation, automation and the intersection of the two through the internet of things are referred to as 'Industry 4.0' (see page 101). New technologies are making factories increasingly more efficient, meaning either fewer employees are needed, or manufacturers can make new products that were previously uneconomic.	"... we don't have many people on site... we just have to have the best, most modern equipment that we can. Otherwise we can't compete." – Manager, 'wood and paper' firm
Demand for tradespeople is strong	The manufacturing sector employs a higher proportion of tradespeople (20% of the manufacturing workforce) than the average New Zealand firm (15% of the workforce). Firms that need very specific technical expertise can also struggle to find these skills in New Zealand's relatively shallow and generalist labour pool.	"Something that is hard at the moment is getting trades workers." – Chief executive, 'plastics and rubber' firm
Sustainability is a growing customer expectation	Demonstrating environmentally responsible behaviour is an expectation rather than a nice to have for manufacturing firms whether their customers are consumers or other businesses. For some firms, such as Antipodes skincare or Miraka milk processing, sustainability is a core part of their value proposition.	"We are carbon neutral as an organisation and we find that it's good business practice because you actually save money by doing it." – Senior executive, 'other manufacturing' firm
Services are increasingly integrated with manufacturing	Services are an increasingly important source of (ideally repeatable) revenues for high technology manufacturers. Software embedded in manufactured goods can enable connection through the internet for ongoing or one-off services such as diagnosis of faults or the collection and analysis of data. Services such as training and maintenance are a growing complement to equipment and machinery exports.	"Our after-sales division has grown significantly in the last 10 years...it might be even exceeding 10% [of revenue]... that could be a contract service for a client to maintain their equipment, a regular service and primarily the sale of spare parts." – Board member, 'machinery and equipment' firm "One of the big drivers for us is the business had made a product but people actually want a service and they want a solution, so we need to stop selling products and provide solutions." – Senior executive, 'wood and paper' firm

SECTION 1

Manufacturing in New Zealand

Manufacturing in New Zealand: Key points

- Most goods that we use in our lives are manufactured.
- Manufacturing is a key driver of economic development.
- The manufacturing sector includes a diverse range of activities and enterprises, grouped into seven subsectors for this report.
- The 'food and beverage' subsector makes up 32% of all manufacturing output, the largest of all manufacturing subsectors.
- New Zealand's small domestic population and geographic isolation have shaped the development and structure of the manufacturing sector.
- Technological change and the reduction of trade barriers are driving change in New Zealand manufacturing today.

Almost everything we eat, wear or touch is manufactured

Manufacturing is the means by which raw materials (e.g. ores, fibres, oils, animals, crops) are transformed into the huge variety of goods we consume or use.

Fresh fruit and vegetables, garden plants and firewood are not manufactured.

Virtually everything else that we use in our homes, at work, on our farms and in our cities has been manufactured.

Manufacturing can be comparatively simple – such as sawing a log into lengths of timber framing – or complex – such as combining plastic, metal, electronic components and software to make Fisher and Paykel Healthcare's medical equipment.

Some manufactured goods are sold to consumers, such as when you buy cheese from your local supermarket. Others are sold only to businesses, such as Tru-Test's milk cooling systems.

Manufacturing is a complicated business. The household detergent you use could be manufactured in New Zealand on contract to an international company to supply the Australasian market. It could be made using chemicals imported from several different countries, and sold in a container made by a plastics manufacturer with labels printed by a printing manufacturer.

Many manufactured goods are the end product of a complex supply chain, starting with raw material suppliers (e.g. steel, plastic, rubber), followed by a number of value-added processes before the manufacture and assembly of the final product.

Manufacturing drives development

Manufacturing – or the process of industrialisation – is a critical component of countries' economic development. Manufacturing has been a key driver of productivity growth, a source of well-paying jobs for low or medium skilled workers, a major investor in innovation and research, and the source of an ever-increasing range of materials, components, capital and consumer goods.

Today the service sectors (e.g. financial services in the UK) are the main drivers of growth and employment in developed economies. While manufacturing may still grow, it will therefore generate a smaller share of the total output in these economies.

A similar development curve is being played out in New Zealand. While manufacturing output has grown in recent years in absolute terms (after a slump during the GFC), its overall share of GDP is declining.

Manufacturing in New Zealand is still, and will likely remain, a large employer. But manufacturing is unlikely to generate significant employment growth in the future. Increased efficiencies, automation and the increasing use of robotics will deliver more output with less, though potentially higher skilled, labour input.

Nevertheless, manufacturing will continue to be central to the New Zealand economy. Manufacturing remains a major exporting sector, and a key producer of products for industries such as construction. In addition, the current shift to adding value to New Zealand's commodity products will require new manufacturing capacity and investment.

Manufacturing also provides a route to market for many services that are embodied within manufactured goods. Manufacturers use transport, warehousing, marketing, advertising, accounting, legal advice and other services, meaning manufacturing's impact on employment extends beyond the sector itself.

> "As economies mature, manufacturing becomes more important for other attributes [than employment growth], such as its ability to drive productivity growth, innovation, and trade. Manufacturing also plays a critical role in tackling societal challenges, such as reducing energy and resource consumption and limiting greenhouse gas emissions."

McKinsey & Company. (2012). Manufacturing the future: The next era of global growth and innovation. McKinsey & Company.

In this report manufacturing is divided into seven separate subsectors for ease of analysis, using standard definitions

ANZSIC Code[1]	Manufacturing subsector	Examples
C11, C12	**Food and beverage** Includes processing of raw materials, e.g. meat processing; milk into milk powder, cheese and butter; as well as all the 'food and beverage' products sold in the centre aisles of a supermarket (including pet food).	Fonterra; ANZCO; Mudhouse Wines; Whittaker's; Tasti; Tegel; Frucor; Miraka; Hellers; Vitaco; Heinz Wattie's; McCain Foods; Kaweka Food Co.
C14, C15	**Wood and paper** **Wood** includes log sawmilling and timber dressing, the manufacture of engineered wood products such as plywood, laminated veneer lumber (LVL), medium density fibreboard (MDF), prefabricated wooden buildings, cabinetry or wood chips. **Paper** includes pulp, paper and card manufacturing and products made from these such as boxes, paper bags, toilet tissue and other packaging.	**Wood:** Tenon; Nelson Pine; Juken New Zealand; Red Stag Timber; XLam. **Paper:** Kinleith Pulp and Paper Mill (Oji Fibre Solutions); Tasman pulp and paper mill (pulp mill owned by Oji Fibre Solutions, paper mill owned by Norske Skog Tasman).
C23, C24	**Machinery and equipment** Includes the production of all kinds of vehicles, from cars to baby strollers; lenses; medical equipment; scientific and measuring equipment; cables, wires and fibre optics; computers and communication equipment; and electrical, domestic, commercial and industrial appliances.	Fisher & Paykel Healthcare; Compac Sorting Equipment; Gallagher Security; Tait Communications; Moffat; SKOPE Industries; Buckley Systems; Scott Technology.
C17, C18	**Chemicals and refining** **Chemicals** products range from cosmetics and pharmaceuticals to household cleaning and industrial chemicals, fertilisers, pesticides, paints and coatings. **Refining** covers the manufacture of petroleum and coal and all related products.	**Chemicals:** Allnex; Ravensdown Fertiliser; Dulux; Resene; Douglas Pharmaceuticals; New Zealand Pharmaceuticals; Trilogy (cosmetics). **Refining:** New Zealand Refining Company.

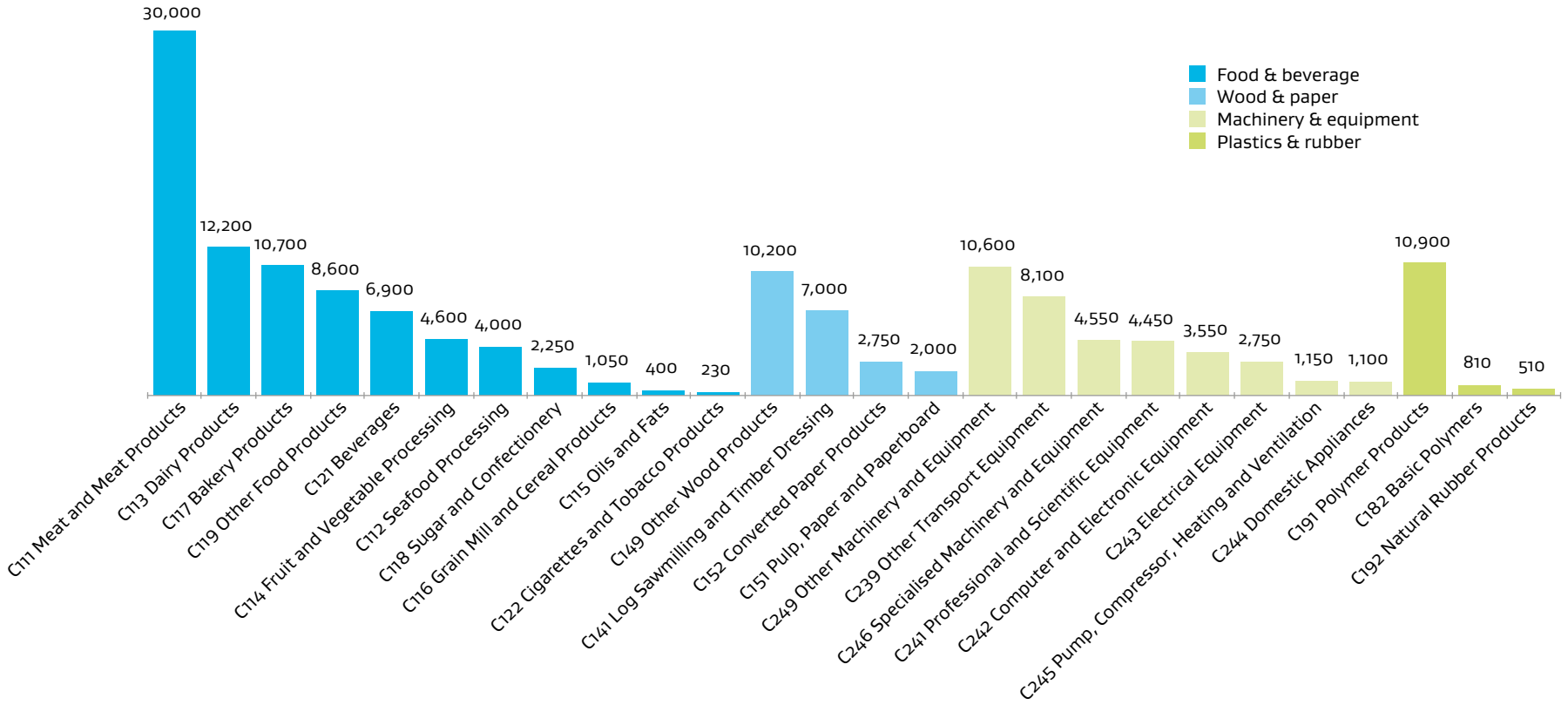
1 Australia and New Zealand Standard Industrial Classification

ANZSIC Code[1]	Manufacturing subsector	Examples
C19	**Plastics and rubber** **Plastic** products range from containers and cling film, to children's playgrounds and many pipes and fittings used in construction. **Rubber** products range from hoses, gumboots and agricultural goods to mud-flaps.	**Plastics:** Alto Packaging Ltd; Axiam Plastics Ltd; Blender Design Ltd; Dynex Extrusions Ltd; Talbot Technologies Ltd; Sistema Plastics. **Rubber:** Skellerup Industries Ltd; Field Rubber Ltd; Rubber Developments Ltd.
C21, C22	**Metals and metal products** Includes the smelting of ore and the creation of a wide range of metal products. These may be small (nuts and bolts) and straightforward (wire for fencing or reinforcing bar) or large (beams and bridge supports) and complex (such as a fabricated metal sculpture).	New Zealand Steel; New Zealand Aluminium Smelters; Steel & Tube; Ullrich Aluminium.
C13, C16, C20, C25	**Other manufacturing** (textiles, leather, clothing and footwear, printing, non-metallic mineral products, furniture and other manufacturing) Effectively, everything else, including furniture and printed material (such as magazines, labels, signs) to clothing and footwear, sports goods, jewellery, umbrellas, textiles and many building products such as windows, bricks, cement, concrete.	Firth Industries; Cavalier Bremworth; NZ Comfort Group (Sleepyhead); Blunt Umbrellas; Alliance Printers Ltd; Minnie Cooper; Metro Performance Glass; Valley Print; Karen Walker; David Trubridge; Coastwood Furniture.

1 Australia and New Zealand Standard Industrial Classification

Within these subsectors employees work in a diverse range of manufacturing enterprises that produce a wide variety of goods

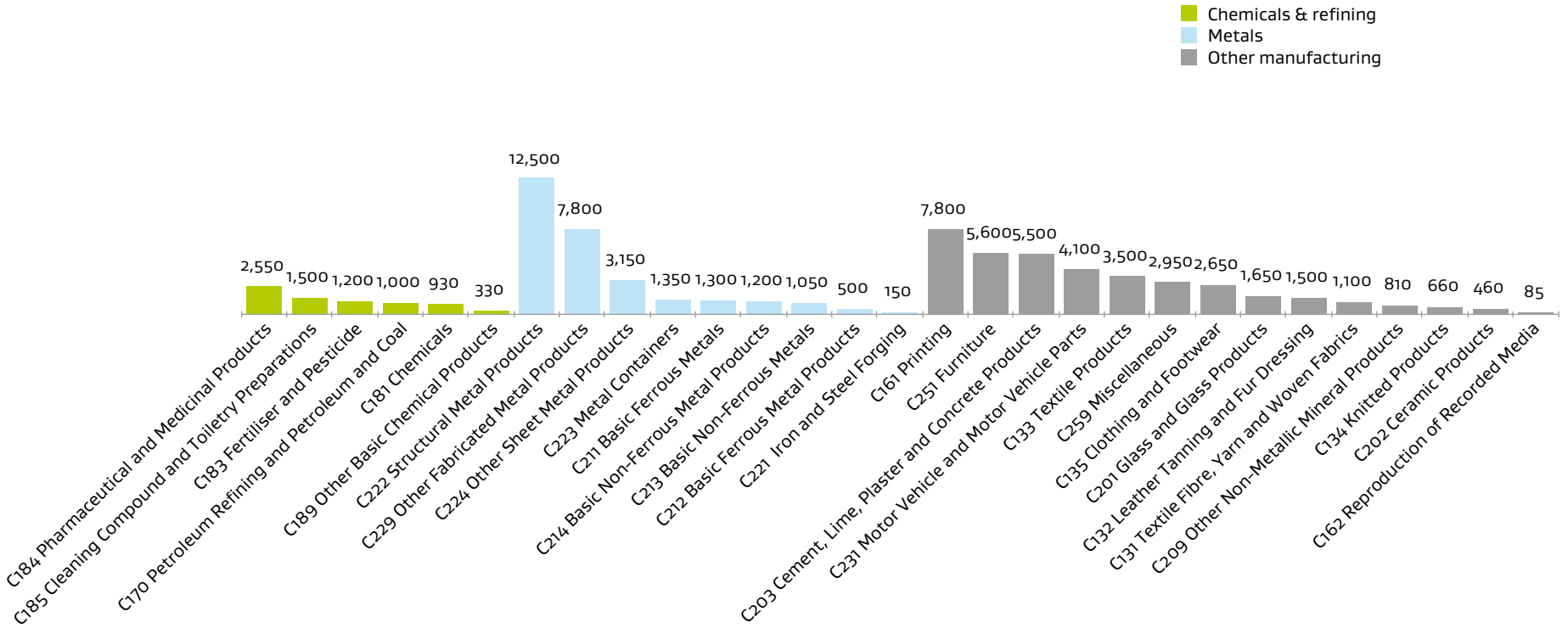
Number of employees by manufacturing classification, ANZSIC level 3
Employees, 2017



Source: Business Demography Survey, Statistics New Zealand

Number of employees by manufacturing classification, ANZSIC level 3

Employees, 2017

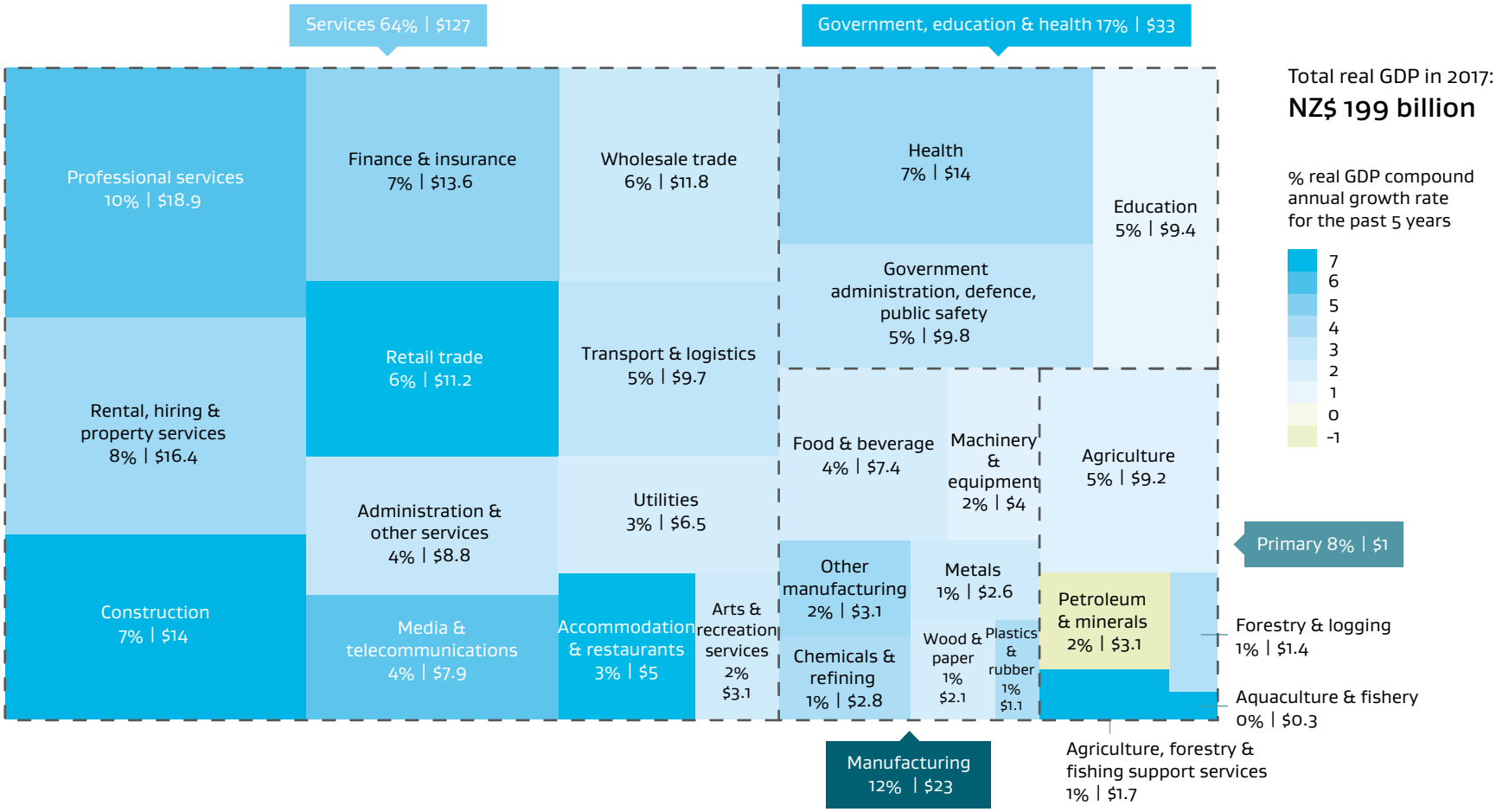


Source: Business Demography Survey, Statistics New Zealand

The manufacturing sector makes up 12% of New Zealand's economy ($23 billion)

Real GDP by major sector

% real GDP; NZ$ billions, year end March 2017



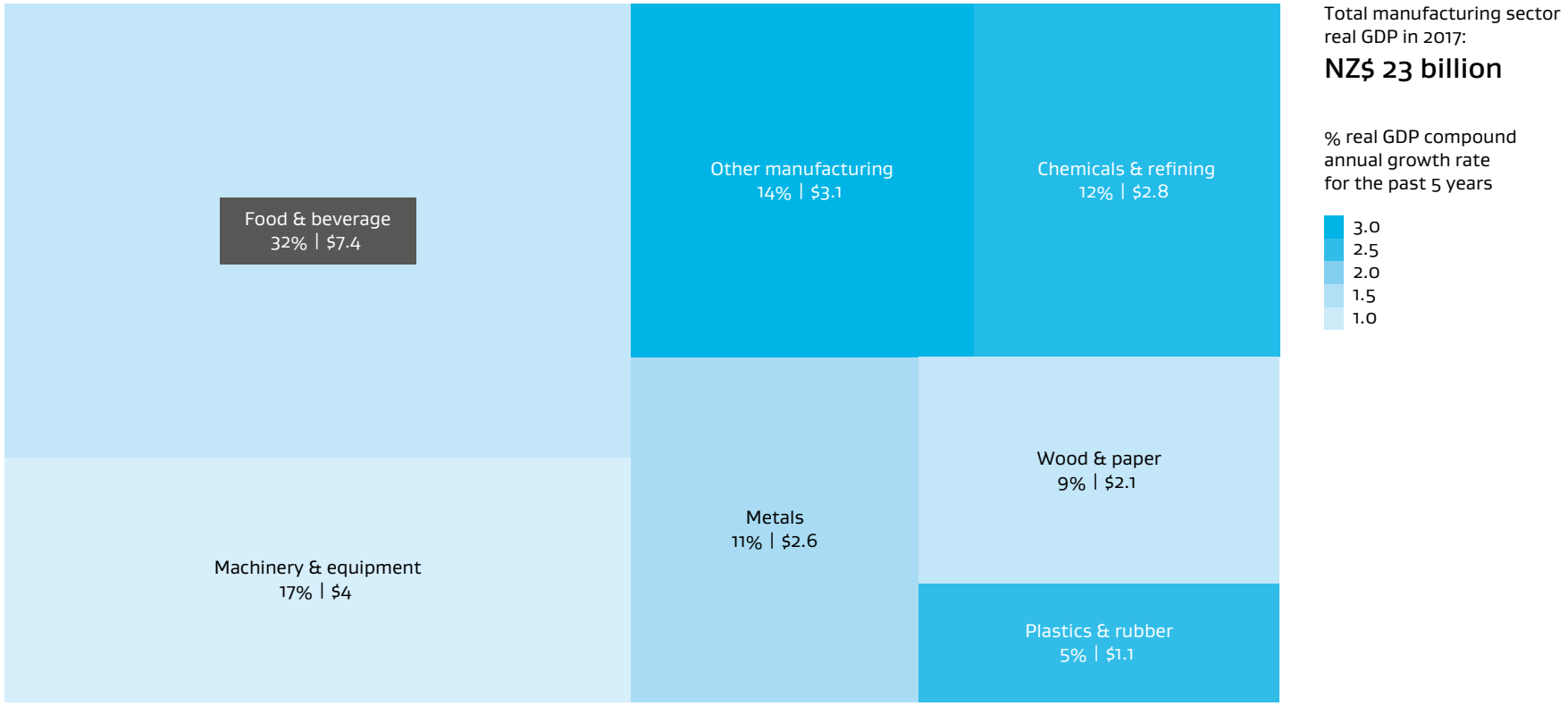
Note: Real GDP is calculated based on 2009/10 prices. Total real GDP figure excludes owner occupied property operations, GST on production and import duties.

Source: National accounts, Statistics New Zealand, and MBIE analysis

‘Food and beverage’ manufacturing is the largest subsector, contributing 32% ($7.4 billion) of all manufacturing output

Real GDP value by manufacturing sector

% manufacturing real GDP; NZ$ billions, year end March 2017

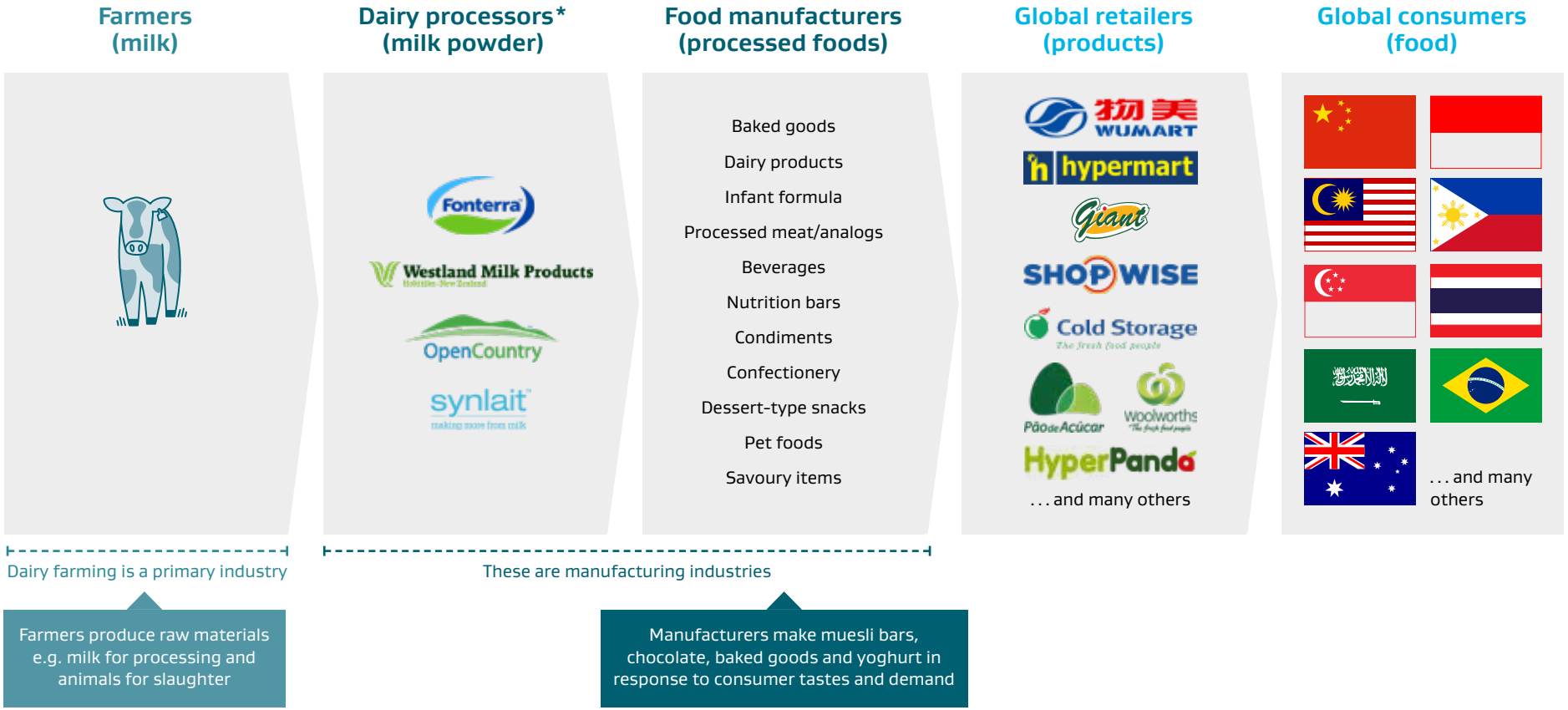


Note: Real GDP is calculated based on 2009/10 prices

Source: National accounts, Statistics New Zealand, MBIE analysis

We tend to categorise all ‘food and beverage’ products as ‘primary products’; in fact most go through a manufacturing process

Example: Flow of New Zealand milk powder from farmer to the consumer
Simplified model; 2010



* Dairy processors produce a range of ingredient and consumer dairy products in addition to milk powder.

Source: Coriolis Research, used with permission.

New Zealand has a small, distant, open market economy; this has shaped the history and current structure of manufacturing in New Zealand

Geographically, New Zealand is relatively large. It is slightly smaller than Italy, but larger than the UK.

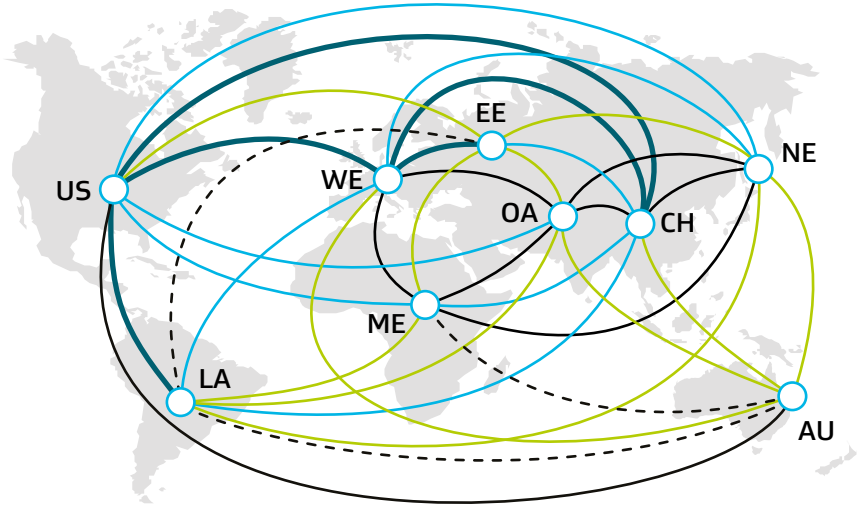
Demographically, New Zealand has a small population relative to its geographical size.

Situated in the temperate zone in the South Pacific, New Zealand is also distant from large markets. Even when including Australia, the proximate market area available to New Zealand firms is small relative to, for example, Singapore or Denmark.

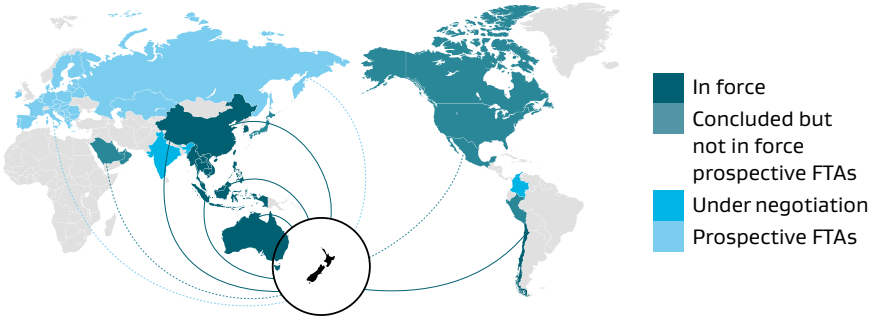
These factors – isolation (distance), small population, favourable climate, large geographical area (much of it difficult terrain) have fundamentally shaped New Zealand's manufacturing sector, and by implication, the economy.

Much of the world perceives New Zealand as being off the map*

Global flows of goods, services, finance, people and data



In fact New Zealand is well positioned for the Asia-Pacific century through its network of free trade agreements (FTAs)



* Global flows map is used with permission from McKinsey & Company.

Source: Ministry of Foreign Affairs and Trade, 2017.

Manufacturing in New Zealand has gone through a number of different stages, driven by changes in markets, technologies and policies

Pre-Industrialisation

Manufacturing work by Māori relied on muscle power. European settlers began to establish manufacturing operations around towns and farms.

Industrialisation

New technology such as refrigeration allowed the export of meat and dairy.

Development of railways in NZ

Railways linked farms to ports to allow the transport of meat and dairy products.

	Early manufacturing	1830s	1840s–1850s	1860s	1870s	1880s–1890s	1900s	1910s
Manufacturing event	Māori produced fibre, rope, fishing nets, kete, mats, clothes, tools and weapons using natural resources.	Europeans processed whale oil at shore based stations and built boats.	Bread, beer, clothes and confectionary manufactured in New Zealand but many goods had to be imported.	The 1860s gold-mining boom buoyed manufacturers. Government bonus schemes rewarded the first company to set up a working manufacturer in a particular sector.	Premier Vogel's public works scheme funded construction, stimulating manufacturing plants that supplied construction materials.	1882 – Refrigerated shipping allows exports of meat and dairy. New firms began producing sugar, cement, footwear and coaches.	The biggest factories were in the wool and clothing industries.	Difficulty of importing due to World War I contributed to more local manufacturing.
New Zealand example				The 1867 census showed 406 manufacturing plants. Flourmills, breweries, sawmills, brick and tile factories, and clothing and boot manufacturers were the main operations. Griffin's Foods established in Nelson in 1864.	1876 – Mataura mill opens, one of New Zealand's first paper mills.	Innovation was a hallmark of early New Zealand manufacturers, for example Thomas Edmond's baking powder. 1888 – First steam powered gold dredge manufactured in Dunedin.	In 1906 the manufacturing workforce was 56,359 (roughly 6% of the total population of New Zealand), of which over a quarter were in Auckland.	A number of businesses established their own factories to avoid supply difficulties after the war, e.g. Fletcher Construction.

This section owes thanks to Professor Gary Hawke.

Development of railways in NZ

Rail transport also contributed to the shift from small manufacturing operations in every town to the consolidation of manufacturing in larger centres with distribution of product via railway.

Protectionism

Import licensing regulations were implemented in 1938 and lasted 50 years. Import substitution became a driving force in New Zealand manufacturing.

Think Big Era

Government funded large-scale industrial projects e.g. the Clyde Dam.

Internationalisation and innovation

Free market reforms and rapid deregulation allowed for cheaper imports into New Zealand. Many manufacturers went out of business. Surviving manufacturers and new startup firms succeeded through innovation and identification of niches in which they could compete.

	1920s	1930s	1940s–1960s	1970s	1980s	1990s	2000s–2010s
Manufacturing event	Mergers and acquisitions saw the development of larger plants, e.g. in the printing and brewing industries.	Import restrictions put in place in 1938 remained until the 1980s. Factories were set up to make what had previously been imported.	Demand for electrical appliances rose in the post-war period. Production of radios, powered lawnmowers, fridges, cookware, electric stoves and bicycles increased. New Zealand consumers were often paying more than they would have for the imported version if they had not been subject to tariffs.	New Zealand moved towards exporting a wider variety of manufactured goods. Rise of oil prices in the 1970s caused inflation and sparked a recession. 1973 – The UK entered the European Economic Community, creating further barriers to NZ exports to the UK ie. quotas on butter and meat.	From the mid-1980s, free market reforms freed up imports and reduced costs to New Zealand consumers. Some manufacturers went out of business. Within 10 years, no cars or television sets were manufactured in New Zealand. 1983 – New Zealand-Australian Closer Economic Relations signed.	Manufacturers increasingly focused on exporting and niche markets in order to remain competitive. Auckland remained the dominant location of manufacturing in New Zealand.	Large-scale manufacturing included forestry, food and dairy. Innovation pursued in order to remain internationally competitive. Growth in digitisation and automation of manufacturing processes. Governments begin active work on developing knowledge industries.
New Zealand example	1926 – General Motors plant opened in Wellington.	1930 – Cadbury began producing chocolate in Dunedin. 1934 – Wattie's founded; Fisher and Paykel established. 1936 – Tip Top Ice Cream Company established. 1939 – Colgate Palmolive began making toiletries.	1952 – Tasman pulp and paper mill opened. 1954 – Kinleith pulp and paper mill opened. 1968 – Spray drying of skim milk commenced at Hokitika Milk Powder Factory. 1969 – Glenbrook Steel Mill began producing.	Glenbrook Steel Mill expanded in the late 1970s and 1980s. 1971 – Tiwai Point Aluminium Smelter opened. Later expanded as part of the Think Big programme.	1981 – Expansion work began on the Marsden Point Oil Refinery. 1987 – Motunui methanol plant began producing. Between 1987 and 1990 the Wairarapa lost 25% of its manufacturing capacity and Clutha and Central Otago lost 35%.		2001 – Fonterra founded. 2001 – Fisher & Paykel Industries splits into healthcare and appliances businesses.

Historically, distance has been a major driver in the development of manufacturing in New Zealand

Distance from markets (e.g. Britain in the twentieth century) meant that in order to export, New Zealand's manufacturers focused on processing agricultural primary products into transport friendly commodity products, e.g. frozen meat, butter, cheese, and, from the late 1960s, milk powder. Abattoirs (freezing works) were initially located near ports, due to lack of internal transport infrastructure.

The capabilities of the New Zealand economy - together with the nature of our international supply chains, distribution and relationships with customers - therefore developed to support commodity exporting.

This is true also for other industries that were established in the twentieth century. For example, pulp and paper mills were established to process New Zealand's plantation forests and methanol plants to process our natural gas into exportable forms.

Historically, "non-primary processing" manufacturing in New Zealand developed mainly to process imports, that is, assembling imported components or ingredients into finished products (e.g. biscuits, radios, cars, other consumer goods) for the local market. In most cases it was cheaper to import components or ingredients into New Zealand and assemble the final product here.

Foreign companies began investing in New Zealand to assemble their products for the local market, or licenced New Zealand manufacturers to do the same, sometimes with New Zealand content. Some companies that started as importers (e.g. Fisher and Paykel) moved into the manufacture of brands under licence and then into their own branded product.

Limited internal transport infrastructure meant that initially factories (such as biscuits or breweries) were located in most cities and towns. The development of New Zealand's internal transport infrastructure lowered the cost of distribution, enabling the consolidation of manufacturing to the major centres.

Globalisation, new technologies and low cost transport are key drivers of change today

Today, low cost highly efficient transport networks and ubiquitous high speed communications, together with a huge reduction in, or elimination of, many trade barriers, have enabled the emergence of global value chains (or 'international production networks').

Production of basic materials such as steel or cotton, manufacture of components such as silicon chips, and final assembly of the product, such as smart phones, appliances or fast fashion, can each be located in the country or region where it can be done most efficiently. The benefit is that consumers have access to a huge range of goods at a significantly lower cost than would otherwise be the case.

In New Zealand this has caused a reversal of the previous dynamic.

Today, many products such as cars, consumer electronics and apparel are cheaper to import in their final form than if they were manufactured or assembled locally. New Zealand assembly of these products has all but disappeared.

Within New Zealand, the lower cost of distribution has enabled consolidation of manufacturing production into fewer factories (e.g. in Auckland) to obtain economies of scale.

Our exports have also significantly changed. For example, in recent times, new technologies in processing, product development, packaging and transport are enabling a much wider range of 'food and beverage' products, beyond simple ingredients, to be manufactured in New Zealand for export. This includes chilled meat in consumer ready packaging and a growing range of sophisticated retail consumer products. It is now possible to export perishable products, such as yoghurt.

These market dynamics are enabling New Zealand's 'food and beverage' manufacturers to add value to our traditional products, or to develop new export products such as energy drinks, smoothies, healthy snacks, and nutraceuticals.

New Zealand's small local market increases the costs of growth and limits the commercial return on investment in innovation and R&D

Issue	Description
Growth	New Zealand's small domestic market, and distance from large markets, acts as a hurdle to businesses trying to grow from small to medium size not faced by businesses in larger countries with large domestic markets and readily accessible export markets. Consequently New Zealand firms striving to grow must be prepared to make a large step up in the size and sophistication of their business in order to expand beyond the limits of our domestic market.
Innovation & R&D	Innovation and R&D expenditure in New Zealand tends to be less profitable because for a specific innovation outcome, the costs of achieving it will be the same as for a larger firm, but the smaller market in New Zealand provides fewer opportunities to earn any commercial payback. Much innovation expenditure can only be justified if it can be applied across a large volume of business, e.g. through exporting.
Market development	Similarly, the fixed-cost components of marketing campaigns, necessary for organic growth, can make the development of brands less attractive in smaller markets.
Acquisition	Merger and acquisition activities can entail significant fixed costs that are relatively more costly for small businesses than large businesses.
Some industries require scale to be competitive	Some industries need scale plants to be competitive, e.g. chemical wood pulp, cross-laminated timber. This means that the business case for establishing these industries may depend on the existence of verified demand in export markets. In addition there is a tension between allowing or facilitating New Zealand firms to achieve scale to gain efficiencies and/or compete internationally and the need to maintain robust competition in the local market, e.g. formation of Fonterra; New Zealand's building products and cement manufacturers.
Internal distance	The issue of a small market is amplified through New Zealand's relatively large geographical size. Supplying many small markets located far outside of major centres is costly due to the increased distances and limited modes of transport available. E.g. sending a product from Auckland to Greymouth requires covering 700km of distance and navigating the Cook Strait.

"Turning to local market size and clusters, New Zealand's population of around four and a half million is smaller than that of many cities. This means that many newly produced products fail to secure a large enough domestic market to attain either economies of scale in production or sufficient local demand to lead to product refinement and development prior to any global launch. Niche and small does not lead to sufficient impact on the economy and hence national productivity or economic growth as a whole even if you sum large numbers of them."

Hong, M., Oxley, L., McCann, P. and Le, T. (2016). Why size matters: Investigating the drivers of innovation and economic performance in New Zealand using the Business Operations Survey. Applied Economics, 48(55), 5379-5395.

Key characteristics of New Zealand manufacturing today

Characteristic	Examples	
Primary and secondary processing of raw materials into products for local consumption and export	**Primary processing*** **Manufacturing processes used to turn a raw material into an industrial material or commodity** › Milk powder › Manufacturing beef › Sawn timber › Steel › Methanol › Aluminium	**Secondary processing** **Manufacturing processes used to turn industrial materials or commodities into finished products** › Infant formula › Hamburger patties › Furniture › Roofing iron › Plastics, paints › Ladders
Large supporting industries (e.g. upstream/downstream industries)	› Agritech industry producing a wide range of products for farms and orchards, and a significant exporter in its own right › Packaging industry (paperboard, plastics, aluminium) supplying food and beverage industry › Fabrication of stainless steel for dairy processing and wine industries › Building products for construction industry	
Small 'heavy industry' sector	New Zealand has a small number of heavy industries, such as chemicals (methanol, fertiliser), petroleum refining, steel and pulp and paper. Most of these were established by governments or with government assistance between the 1950s and early 1980s. Most of them were also established to take advantage of a natural resource, e.g.: Glenbrook Steel Mill and iron-sand; pulp and paper and large plantation forests; aluminium smelting and cheap hydro-electricity; methanol production and plentiful natural gas.	

* Primary processing does not mean primary industry.

Characteristic	Examples
Small number of large firms	There are 300 manufacturing firms in New Zealand with more than 100 employees. 108 of these are in 'food and beverage' manufacturing. The most R&D intensive manufacturing subsector, 'machinery and equipment' manufacturing, includes just 51 firms that employ more than 100 people. In the European Union firms with up to 500 employees are defined as small and medium enterprises (SMEs).
Large number of mostly small firms manufacturing a wide array of products	Everything from industrial brushes, footwear and furniture to umbrellas and cleaning products. Many of these firms fly under the radar. "We are not sexy. . . we do toilet care and killing bugs. It's not really front page stuff is it?" – Chief executive, chemicals manufacturer.
Emergence of high and medium-high technology exporters	111 of the 200 firms profiled in the TIN report 2017 are engaged in manufacturing a wide range of high and medium-high technology products, generating $6.5 billion in revenues. Of these firms 44 were founded after 1990, and this group generated close to $1.5 billion in revenues. Exports of high and medium-high technology goods were valued at $4.8 billion in 2016.
Emergence of processed foods	Defined as products made from a mixture or combination of ingredients, rather than a single ingredient, and the firms that predominantly make these products. Exports were valued at $4.77 billion in 2017 with year-on-year growth of 12% (+$446m). Strong growth is driven by infant formula and nutritional products (e.g. whey protein), snacks and nutraceuticals. Growth is coming from premium pricing and a shift to quality.*

* Processed foods are defined as Harmonised Trade Codes 16–21 plus pet food. This is a broader definition than that used in the 2017 Investor's Guide to the New Zealand Processed Food Industry.

Case Study: The complex production network for toasters

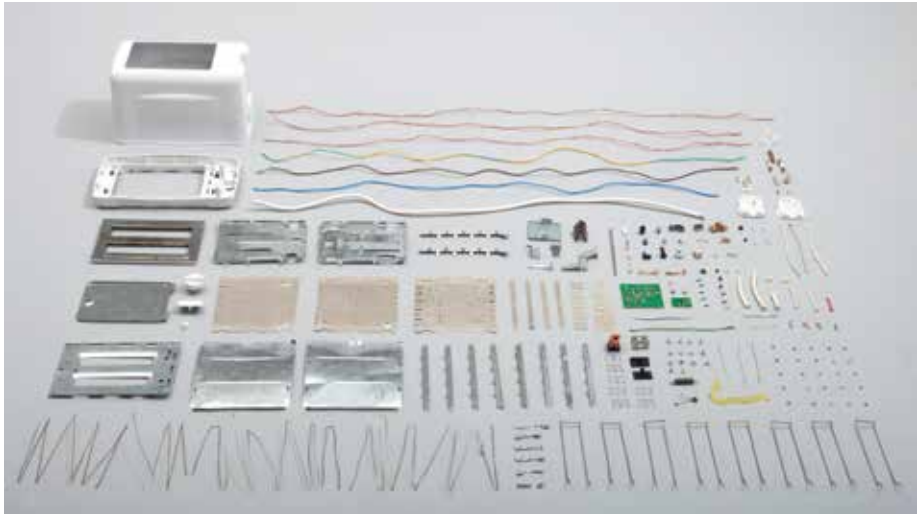
Modern manufacturers produce billions of highly complex products every day. Global supply chains mean that manufacturers can obtain materials from all over the world for the variety of components used in their products.

Productivity is high as manufacturers build expertise in a particular process and become efficient at producing particular products. The manufacturing sector is also highly interconnected – many manufacturers produce components which are inputs into other manufacturers' products.

Thomas Thwaites, a designer with an interest in science and technology, demonstrated the complexity of modern manufacturing when he attempted to make a toaster from scratch. An ordinary toaster has more than 400 components and sub-components, made from nearly 100 different materials. Thwaites' toaster used just iron, copper, plastic, nickel and mica (a ceramic).

Thwaites travelled to former mines for iron ore, scavenged plastic (being unable to get oil to truly make plastic from scratch), obtained copper via electrolysis from the polluted water of an old mine, and melted coins for nickel. Manufacturing processes included smelting the iron using a microwave, and melting plastic to mould into a casing.

The result was a barely functional toaster that cost over £1,000 in time and resources. In a world where consumers can access a range of toasters for as little as NZ $10, Thwaites' project demonstrates the complexity and productivity of the world's highly globalised and interconnected production networks.



Source: Thwaites, T. (2011). The Toaster Project, or, a Heroic Attempt to Build a Simple Electric Appliance from Scratch. Princeton Architectural Press.

Thwaites, T. How I Built a Toaster from Scratch. TED Talks. Available from: https://www.ted.com/talks/thomas_thwaites_how_i_built_a_toaster_from_scratch

Images used with permission of Thomas Thwaites.

Industry commented on the challenges and benefits of manufacturing in New Zealand

"There were two key drivers in the movement away from New Zealand manufacturing. One was the tyranny of distance which our competitors played on continually. And the other driver was purely the cost of manufacture."

Board member, 'machinery and equipment' firm

"I'm a very passionate Kiwi but we are quite a weird bunch of people. We have odd senses of humour, we have very strange language and our accent is a bit odd. . .a big part of it is just we are so far removed culturally from a lot of our markets."

Chief executive, 'other manufacturing' firm

"We have to export to survive. If you are in China just sitting outside Shanghai and you build a relationship with the local supermarket, then you've got 100 million people within 100kms, you don't really need to be an exporter."

Chief executive, 'chemicals and refining' firm

"[E]very now and then, one factory closes – it may be quite a small one, but it affects a number of other companies they have been supplying to, especially if they're one of the only ones left to provide a particular service."

Dieter Adam, Chief Executive NZMEA, quoted in NZ Herald 23 Feb 17

". . .because we are seen as being one of the more transparent, honest, decent countries to do business with, we are very well trusted and we are not seen as a threat."

Senior executive, 'machinery and equipment' firm

"[New Zealand made] is one of our selling points. Some people are prepared to pay a premium."

Operations manager, 'other manufacturing' firm

"[New Zealanders] do have an unusual ability to be able to pull things together much better than other countries and at much lower cost."

Chief executive, 'plastics and rubber' firm

"I think we are very fortunate in New Zealand, our economy has been very good for a number of years so that's certainly helped us."

Anonymous

SECTION 2

Contribution to GDP and productivity

GDP and productivity: Key points

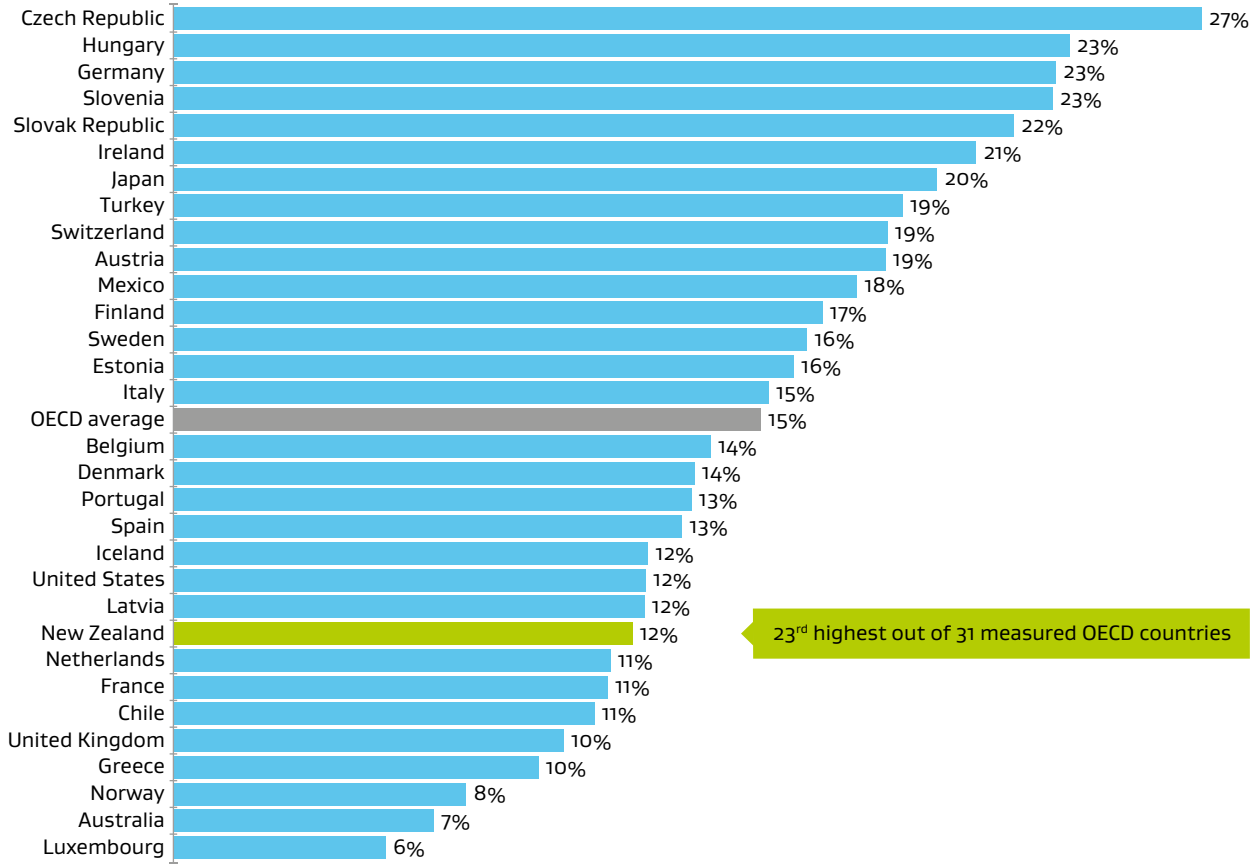
- Manufacturing contributed 12% of New Zealand's real GDP ($23 billion) in 2017.
- The last ten years has been a game of two halves. Overall manufacturing output (real GDP) declined in the ten years to 2017, largely due to the impact of the GFC. In the last five years output growth has recovered, but is still below 2007 levels.
- New Zealand recorded average annual labour productivity growth of 1% over the last ten years. Productivity growth has been highest in the primary sector (2%) and lowest in the manufacturing sector (0.2%).
- Manufacturing subsectors vary widely in productivity performance. 'Plastics and rubber', 'chemicals and refining', and 'other manufacturing' achieved ten-year productivity growth above the average rate for the whole economy, while 'food and beverage' and 'metals' subsectors had negative ten year productivity growth rates.

New Zealand ranks 23 out of 31 OECD countries in terms of manufacturing's contribution to GDP

This is less than the share of GDP in similar sized countries such as Ireland or Finland, but more than Australia or the United Kingdom.

Manufacturing share of GDP

% GDP, 2014



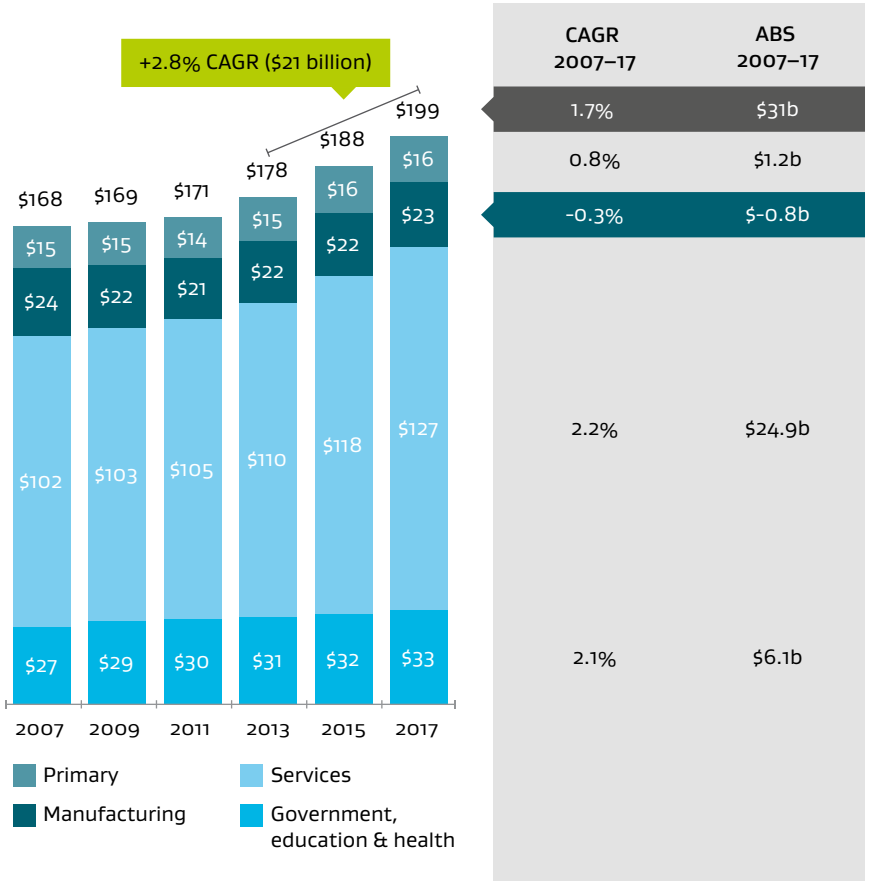
Note: South Korea, Canada, Israel and Poland were not included due to lack of data.

Source: National accounts, OECD.

New Zealand's total output (GDP) grew by $31 billion in the ten years to 2017, driven by services; manufacturing's share of GDP has declined

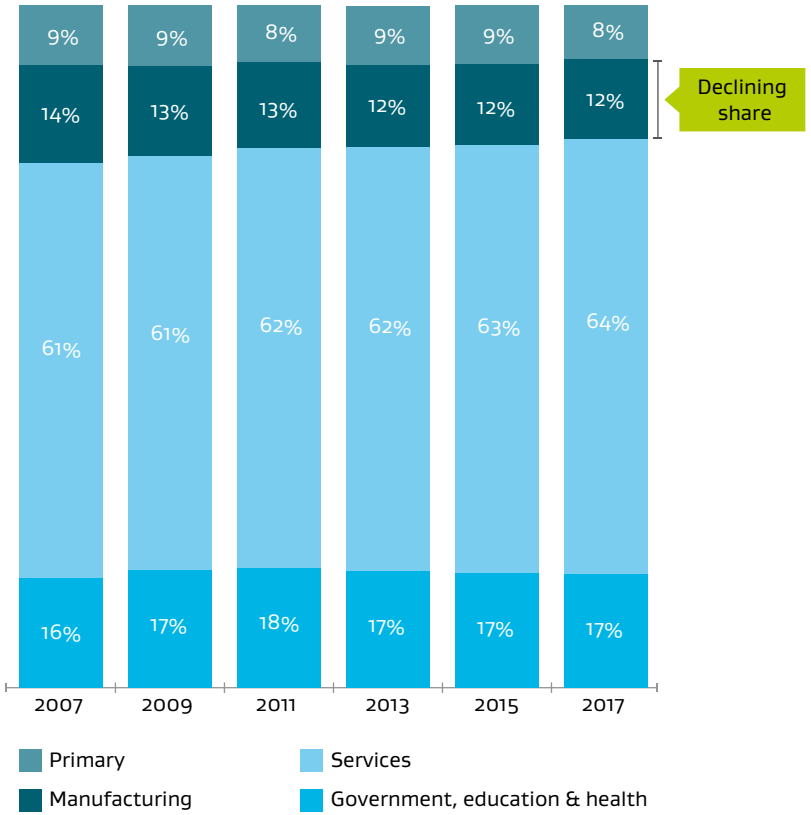
Real GDP value by major sector

NZ$ billions, year end March 2007–2017



Real GDP share by major sector

% real GDP, year end March 2007–2017



Note: Real GDP is calculated based on 2009/10 prices.

Source: National accounts, Statistics New Zealand, MBIE analysis.

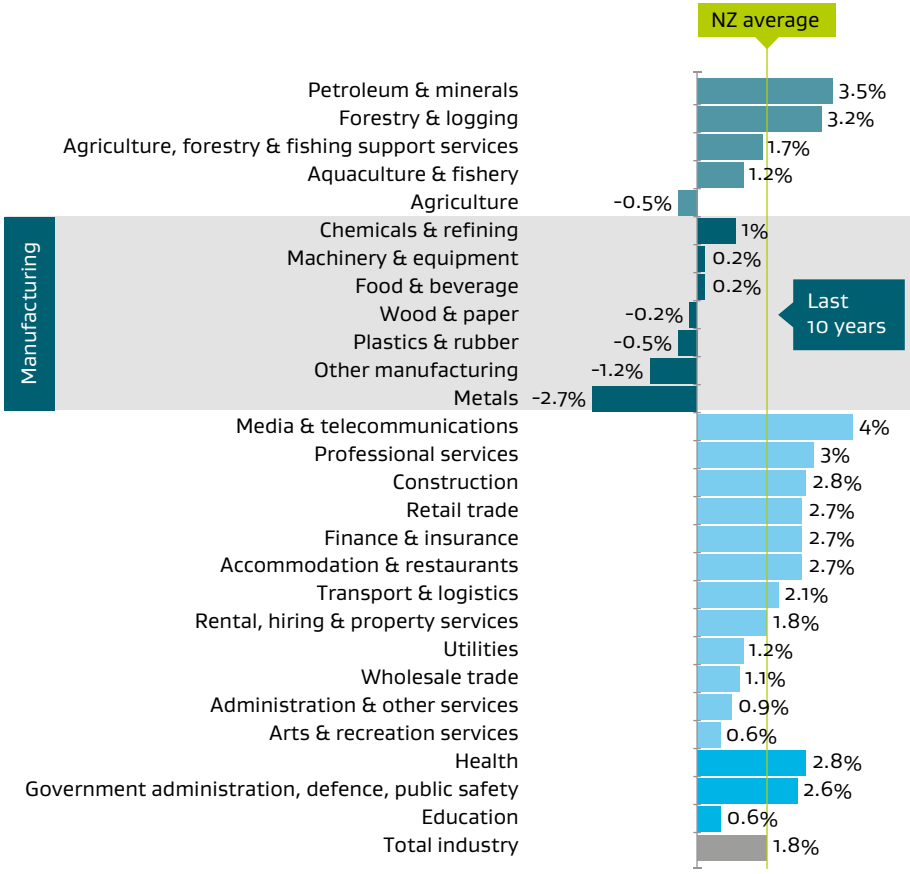
Note: Real GDP is calculated based on 2009/10 prices.

Source: National accounts, Statistics New Zealand, MBIE analysis.

The manufacturing sector as a whole experienced a decline since 2007, but returned to growth in the last five years

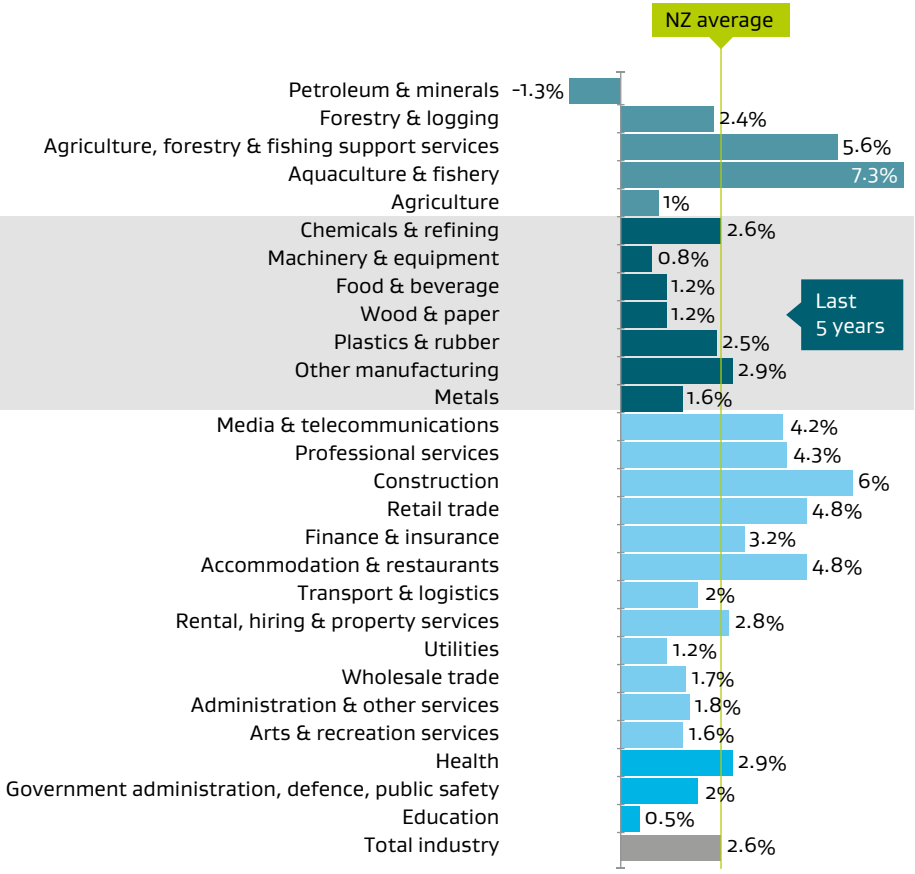
Real GDP 10 year growth rate

% GDP CAGR, year end March 2007–2017



Real GDP 5 year growth rate

% GDP CAGR, year end March 2012–2017

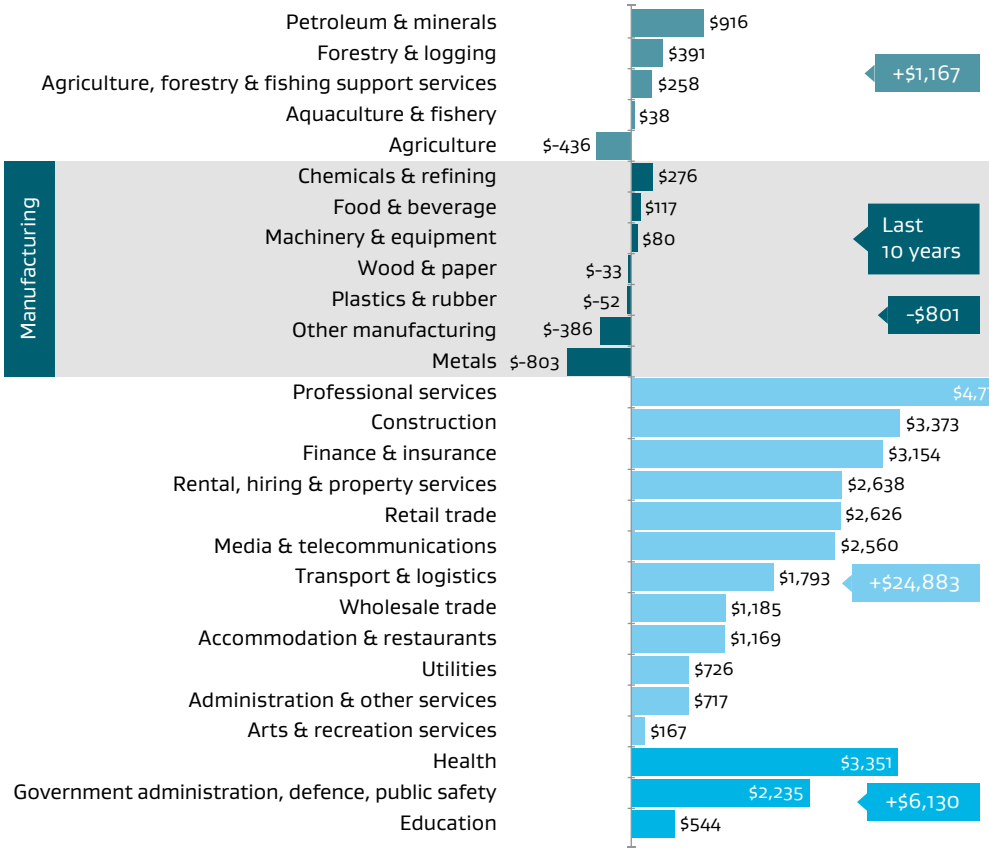


Note: Real GDP is calculated based on 2009/10 prices.

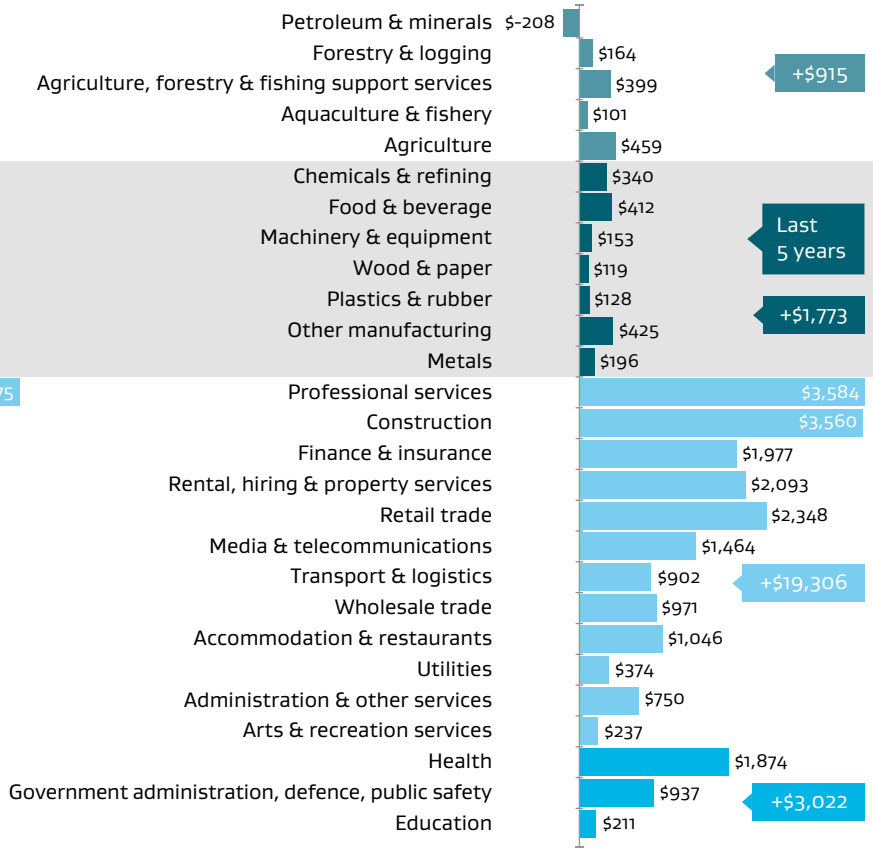
Source: National accounts, Statistics New Zealand, MBIE analysis.

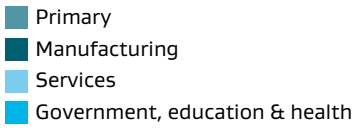
Manufacturing output declined by $801 million in the ten years to 2017; 'other manufacturing' and 'food and beverage' have driven recovery in the last five years

10 year absolute change in real GDP
NZ$ millions, year end March 2007–2017



5 year absolute change in real GDP
NZ$ millions, year end March 2012–2017



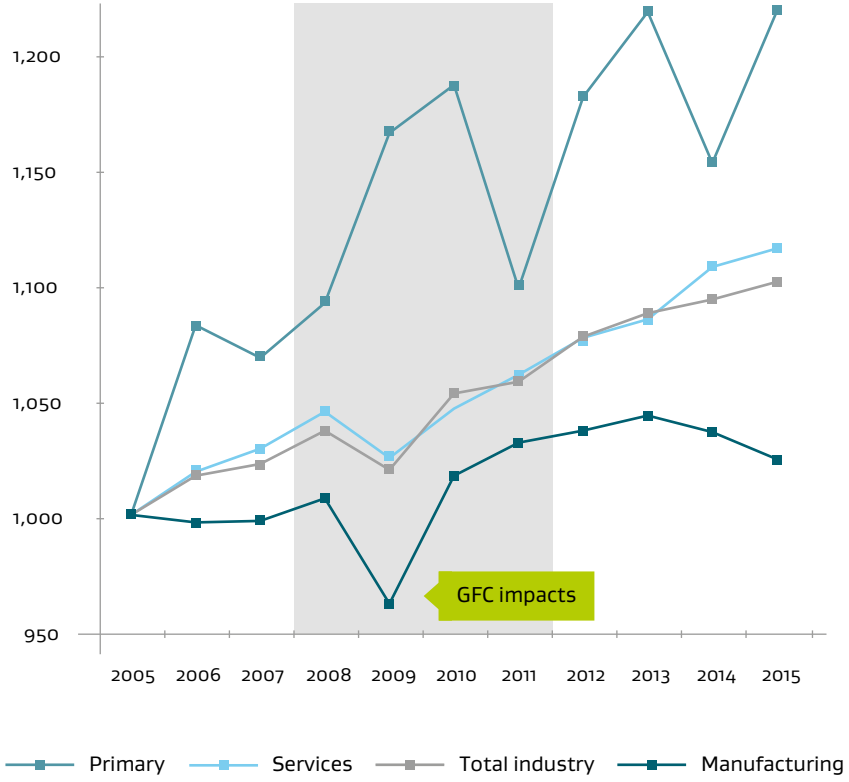


Note: Real GDP is calculated based on 2009/10 prices.

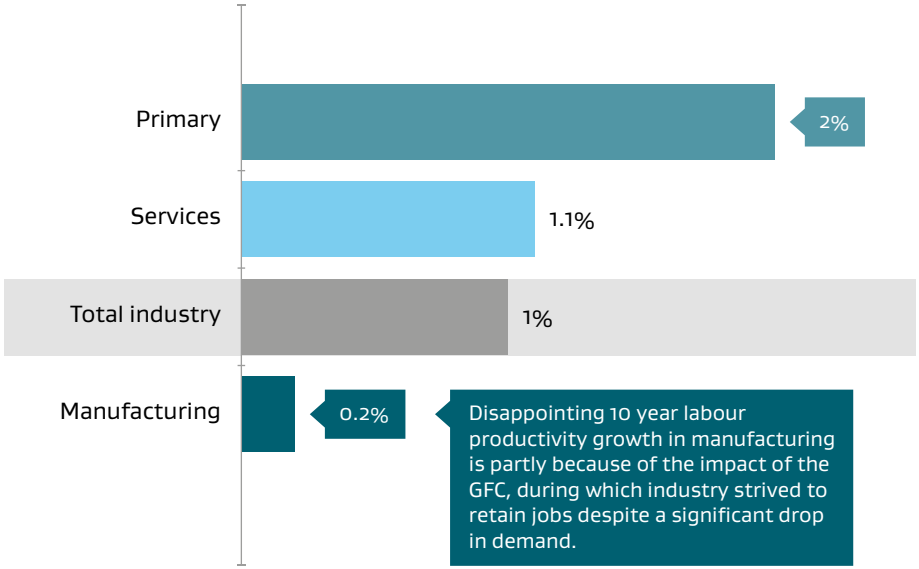
Source: National accounts, Statistics New Zealand, MBIE analysis.

Productivity growth across all sectors of the New Zealand economy averaged 1% per year in the ten years to 2015; it was lowest (0.2%) in the manufacturing sector

Labour productivity by major sector
Productivity, 2005–2015



Labour productivity growth by major sector
% productivity growth CAGR, 2005–2015

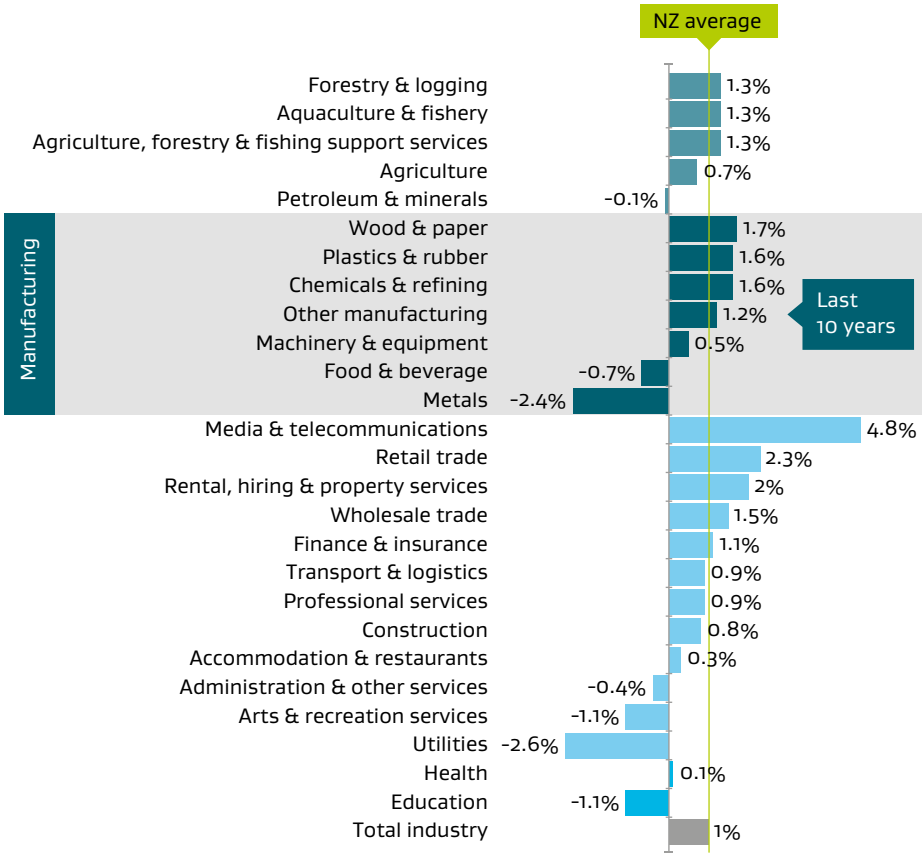


Source: Productivity statistics, Statistics New Zealand, MBIE analysis.

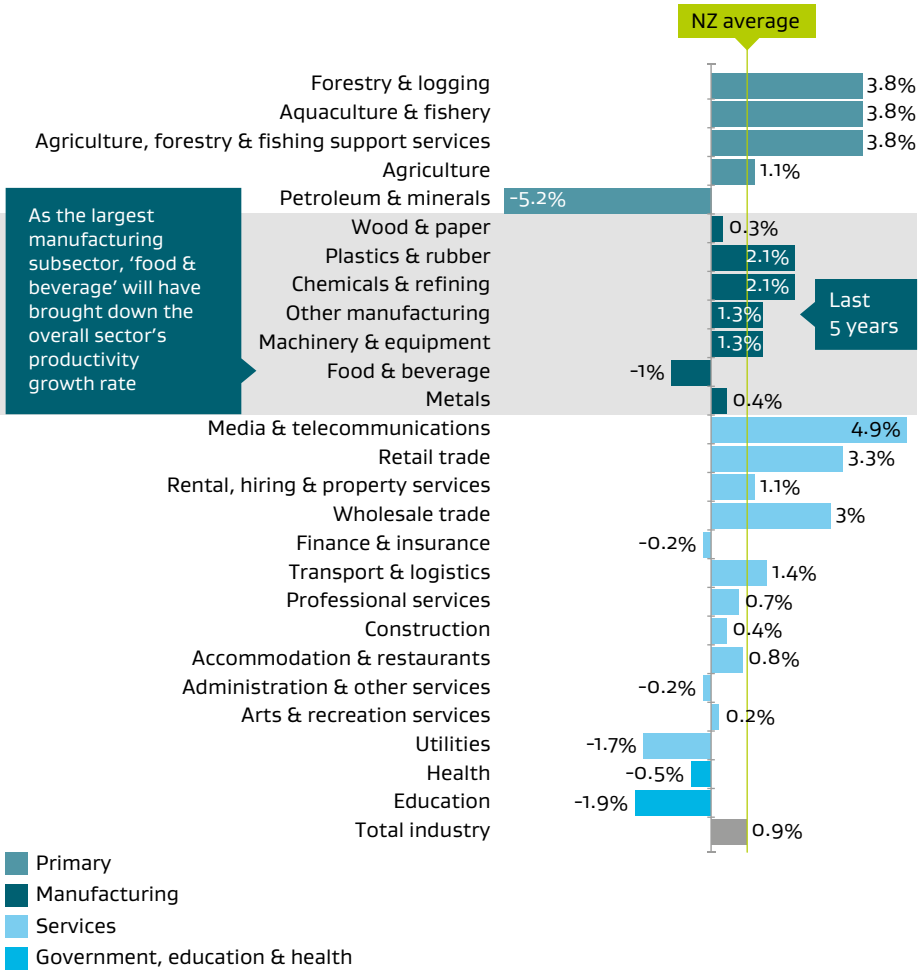
Productivity growth varies across the manufacturing subsectors

‘Plastics and rubber’, ‘chemicals and refining’ and ‘other manufacturing’ achieved consistent growth rates above the New Zealand average.

10 year labour productivity growth
% productivity growth CAGR, 2005–2015



Five year labour productivity growth
% productivity growth CAGR, 2010–2015



Source: Productivity statistics, Statistics New Zealand, MBIE analysis.

New Zealand's labour productivity performance is poor compared to other OECD countries

Productivity is a ratio that measures how efficiently inputs – capital and labour – are used in the economy to produce goods and services.

The most common measure is labour productivity, as used in the charts in this report. The measure used is the amount of goods or services that are produced in an hour of paid work. The more that is produced in an hour, the higher the rate of labour productivity.

Productivity is the most important source of income growth.

When labour productivity growth is strong, wages for New Zealand workers increase faster.

The Productivity Commission states that ***"By delivering more for less, higher productivity brings more opportunities and choices."*** This can mean investing in better quality health care and education, excellent infrastructure and protecting our environment.

New Zealand's labour productivity performance has been weak for a long time.

This is a key reason why New Zealand's income levels are more than 20% below the OECD average even though our broad policy settings are considered to be at, or close to, best practice.

Uptake of new technologies and the reallocation of resources – where labour and capital flow to more productive firms – are key drivers of productivity growth. Productivity Commission work shows that technology diffusion and resource reallocation do not work as well as they could in New Zealand. There are several reasons for this.

*"**First, most New Zealand firms operate in very small markets.** Compared to other small countries, New Zealand firms are not well connected internationally and domestic markets are often small and insular, particularly in the regions. So technology diffusion is weak and productive firms cannot grow and expand, while unproductive firms do not feel the heat of competition and exit.*

***Second, the economy is capital shallow:** investment is low as a share of GDP and especially relative to employment. In part this reflects fast population growth, including strong migration inflows.[1] The cost of capital in New Zealand may also be relatively high. . . while labour is relatively cheap. This might also contribute to low capital per worker.*

***Third. . . evidence suggests that New Zealand firms have been slow to invest in knowledge-based assets,** which are becoming increasingly important in driving productivity improvements. For example, investment in R&D is low, and the available evidence suggests that managerial capability is weak within New Zealand firms.*

*Importantly, **aspects of this story are self-reinforcing.** For example, New Zealand firms are small because they operate in small and insular markets. So they struggle to learn from global frontier firms and have limited revenues to invest in capital, including knowledge based assets. In turn, this restricts productivity growth, making it more difficult for these firms to connect into larger international markets. And so it goes." (Conway, P. 2017)*

1 If there is sufficient labour supply, firms do not have an incentive to invest in capital.

Conway, P. (2017). Productivity and Changing Technology. *Policy Quarterly* 13:3, pp46-49

Conway, P. (2016). *Achieving New Zealand's Productivity Potential*, research paper 2016/01, Wellington, New Zealand Productivity Commission.

MBIE. (2016). *What we know (and don't know) about economic growth in New Zealand*, Working Paper 16(1), Wellington, MBIE Strategic Policy Branch.

Industry commented on the impact of competitive pressures

"There isn't a lot of large-scale consumer manufacturing happening here anymore because we're not competitive on that front. There are some exceptions but the vast majority of manufacturing these days is business-to-business, highly specialised short runs of bespoke items."

Chief executive, industry association

"We are competing with low price manufacturers in Indonesia and Thailand and Malaysia. We have to be as efficient as we can. . . because manufacturing at scale can't run in New Zealand."

Manager, 'wood and paper' firm

"We are doing more jobs and shorter runs so we've got to be smarter and we've got to invest in technology and the tools and processes to enable us to flip from one set to another very, very quickly."

Senior executive, 'other manufacturing' firm

"Manufacturing is a tough gig in New Zealand. You've got to be niche or specialist. . ..Your service, your standards, the support of your customers and everything else has to be first class because there's just heaps and heaps of competition."

Managing director, 'plastics and rubber' firm

SECTION 3

Firms and employment

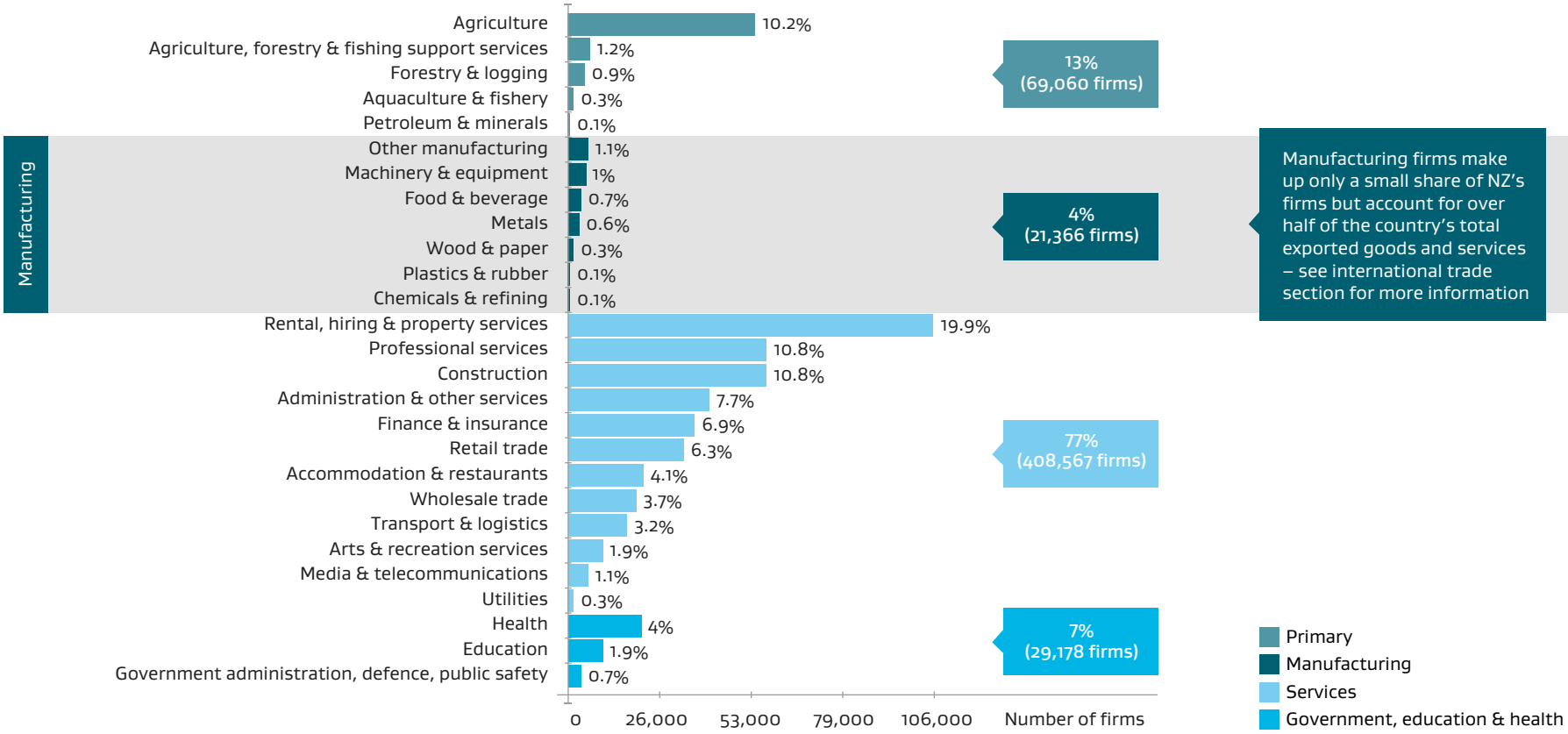
Firms and employment: Key points

- In the New Zealand economy, manufacturing accounts for:
  - 11% of national employment (241,100 employees in 2017)
  - 4% of all firms (21,366 firms in 2017)
- There are 300 large (100+ employees) firms in the manufacturing sector, of which 108 are in 'food and beverage' manufacturing.
- Close to 50% of those employed in manufacturing are employed by the 300 large firms.
- 'Other manufacturing' and 'machinery and equipment' subsectors account for over half of all manufacturing firms.
- 'Food and beverage' and 'machinery and equipment' subsectors account for 48% of firms that employ more than 50 people.
- In 2017 manufacturing firm deaths exceeded firm births.

4% of all New Zealand firms are in the manufacturing sector (21,366 firms)

Share of firms by sector, classified by principal activity of firm

% of firms, 2017



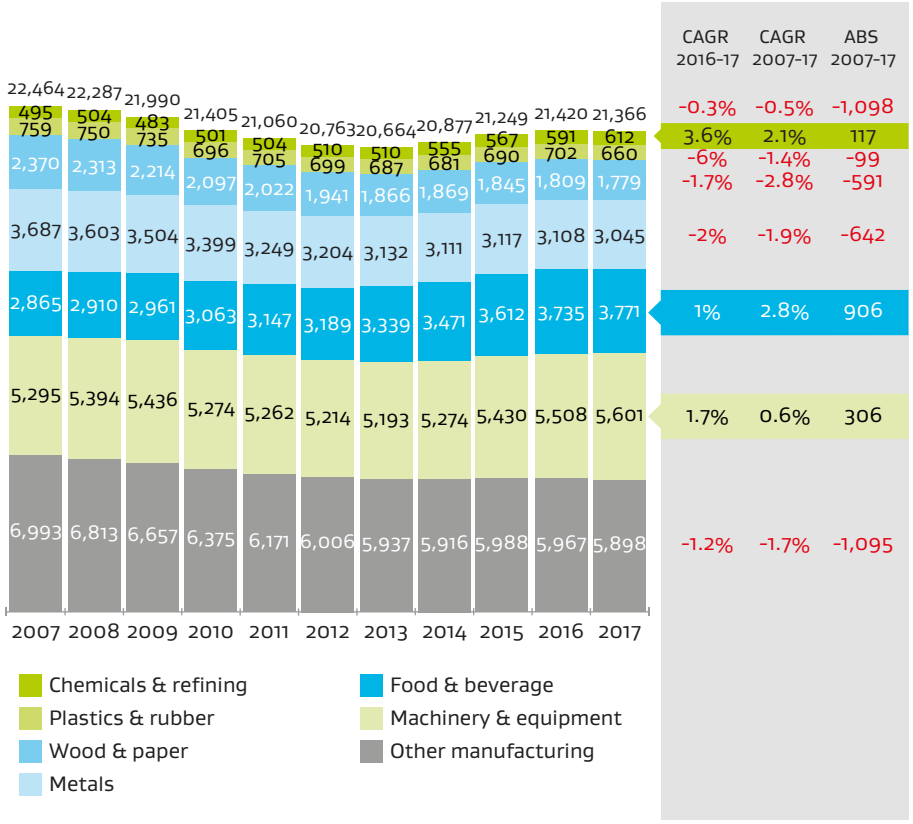
Source: Business Demography Survey, Statistics New Zealand, MBIE analysis.

Overall manufacturing firm numbers declined slightly from 2007 to 2017

'Food and beverage', 'machinery and equipment' and 'chemicals and refining' subsectors are adding firms

Number of firms by subsector

Firms, 2007–2017

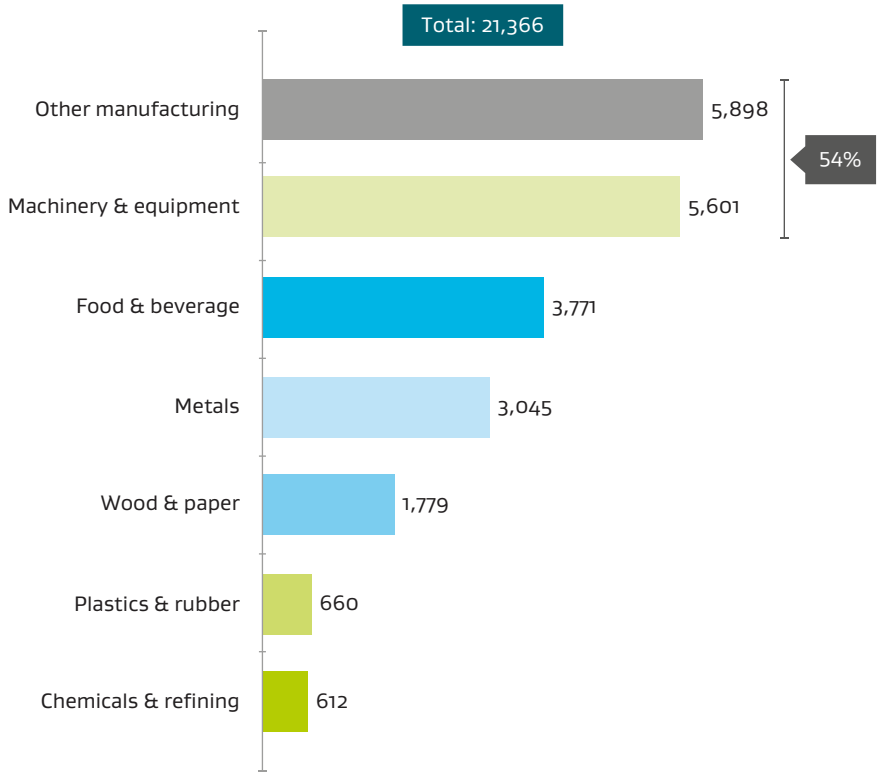


Source: Business Demography Survey, Statistics New Zealand.

'Other manufacturing' and 'machinery and equipment' subsectors make up 54% of all manufacturing firms

Number of firms by subsector

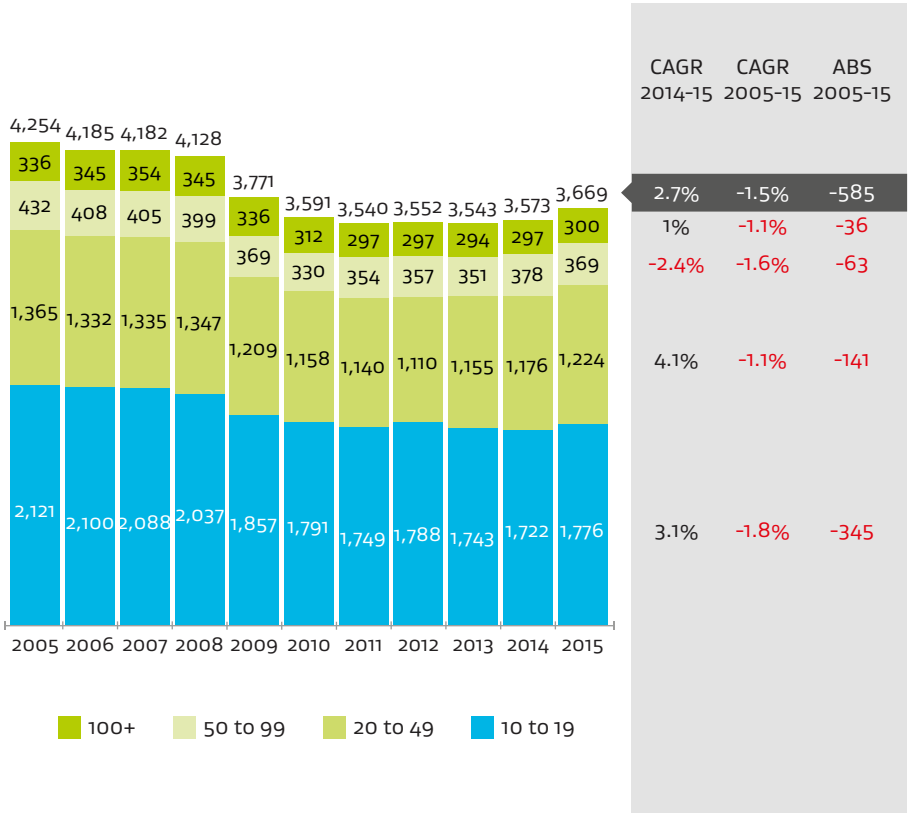
Firms, 2017



Source: Business Demography Survey, Statistics New Zealand, MBIE analysis.

The number of manufacturing firms employing 10 or more people decreased from 2005 to 2015

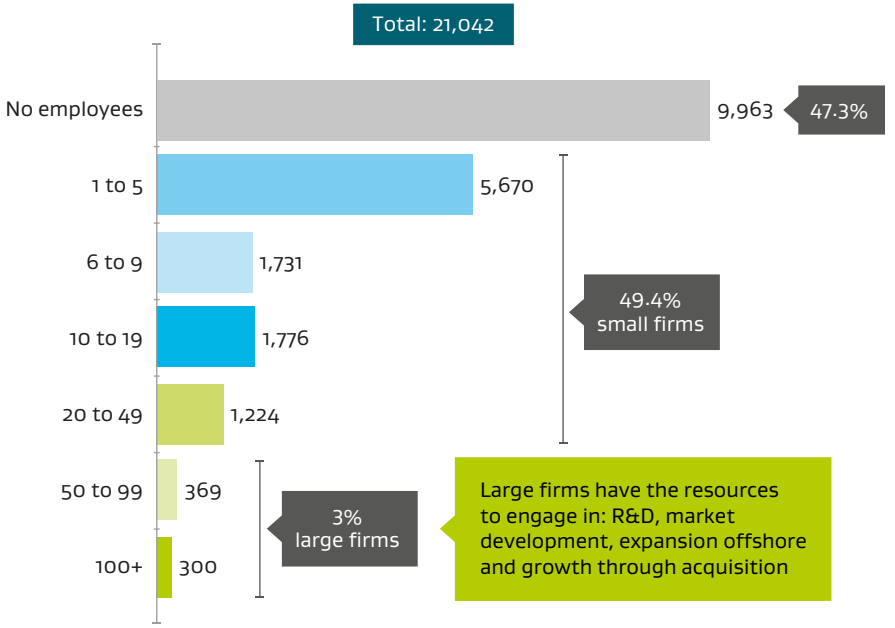
Number of firms by employee numbers (ten employees and more)
Firms, 2005–2015



New Zealand manufacturing is largely comprised of small or very small firms

Just 3% of firms employ more than 50 workers

Number of firms by employment size
Firms, 2015



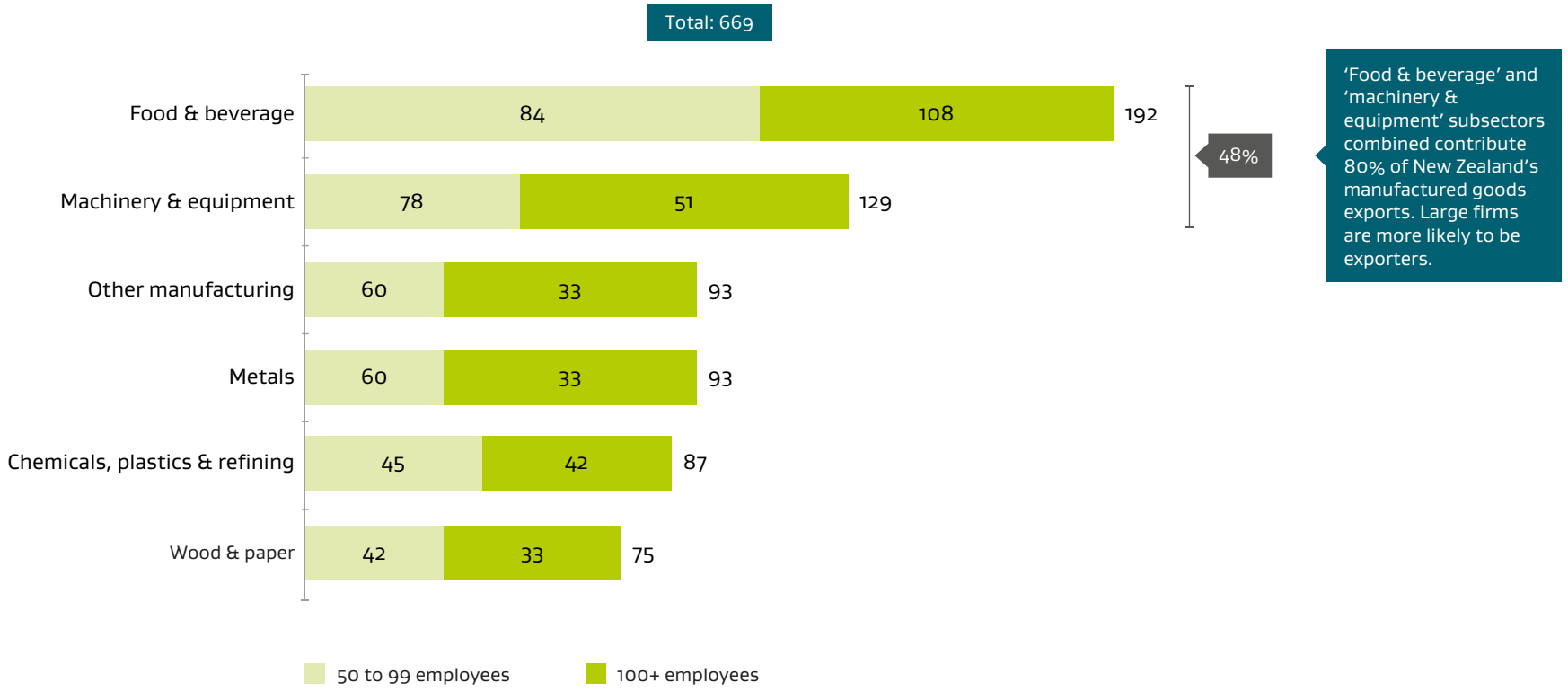
Source: Business Demography Survey, Statistics New Zealand.

Source: Business Demography Survey, Statistics New Zealand, MBIE analysis.

Note: Totals may not match other pages due to rounding. More recent data could not be obtained due to a change in statistical methods.

The ‘food and beverage’ and ‘machinery and equipment’ subsectors account for 48% of the manufacturing firms that employ more than 50 people

Number of large manufacturing firms by subsector
Firms, 2015



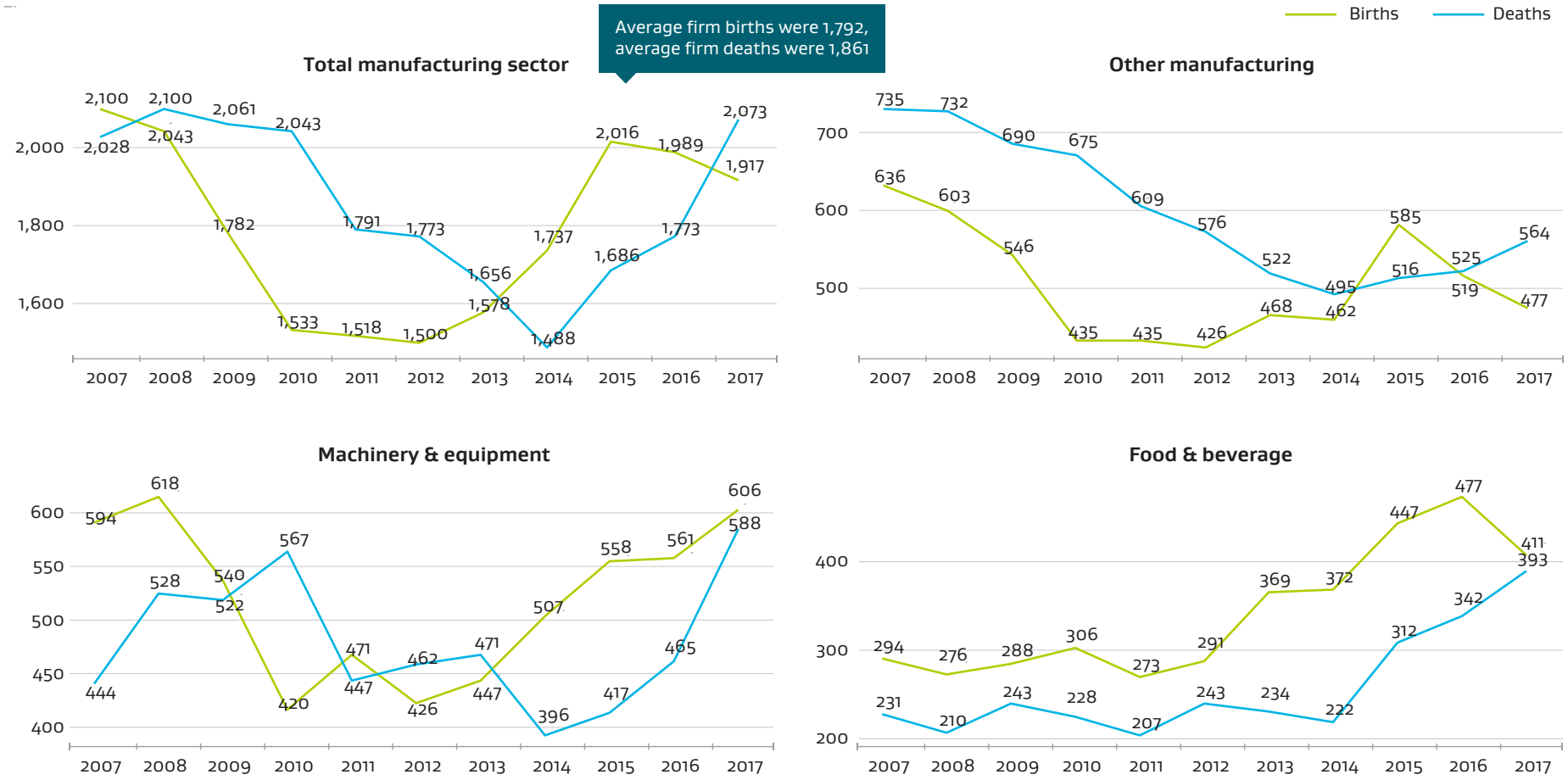
Note: More recent data could not be obtained due to a change in statistical methods.

Source: Business Demography Survey, Statistics New Zealand, MBIE analysis.

The annual number of manufacturing firm deaths exceeded births in 2017 after three years of growth

The ‘other manufacturing’ subsector had 87 more firm deaths than births in 2017, the largest difference for any subsector

Number of births and deaths of manufacturing firms

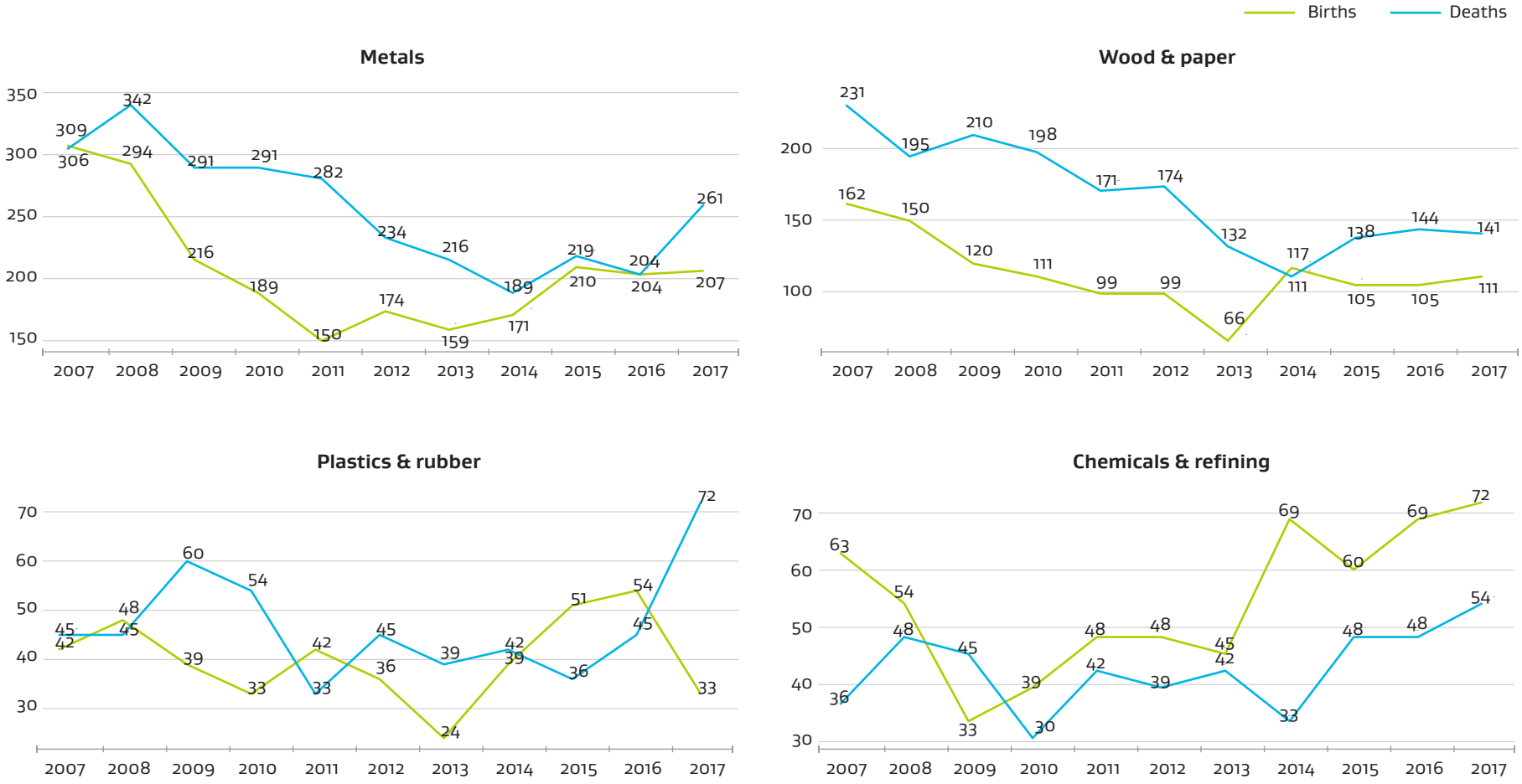


Source: Business Demography Survey, Statistics New Zealand.

‘Metals’ and ‘wood and paper’ subsectors have consistently experienced more firm deaths than births since 2007, possibly indicating consolidation

Number of births and deaths of manufacturing firms

Firms, 2007–2017



Source: Business Demography Survey, Statistics New Zealand.

Industry commented on their experience of manufacturing in New Zealand

"The GFC was quite a hurdle and we were able to weather the storm but it had some cost to the business. . . we didn't spend as much as we could have done on R&D and that has a flow on effect. We lost some of our key staff and that has a flow on effect. Those things take time to rebuild and get back up to speed again."

Board member, 'machinery and equipment' firm

"I think many New Zealand companies think 'great we are made in New Zealand, that's wonderful, everyone wants us'. Well it's a value add but it's not a reason for a consumer to buy a product. It has to be good, it has to compete first, and then the fact that it comes from New Zealand is your value add."

Founder, 'chemicals and refining' firm

"We've got an efficient manufacturing base, we've got a stable workforce, so New Zealand is doing okay in certain things. What we can't control is what happens in the port and exchange rates."

Manager, 'wood and paper' firm

"We suffer from import competition. A large producer offshore can pick the top 20 selling products only and aggressively price these."

Managing director, 'plastics and rubber' firm

"Manufacturers are very much dependent on freight rates, demand and exchange rates. . .those are the challenges of a manufacturer in New Zealand."

Manager, 'wood and paper' firm

"Probably 95% of what we sell is manufactured in New Zealand. Would I be financially better off if I moved all that into China? Absolutely. So why do we do it? Well every high tech company like us needs an element of manufacturing to validate our design. It's difficult to try and do that when your manufacturing facilities are a long way away. But. . .there are definitely times that I feel that I'm just swimming against the tide."

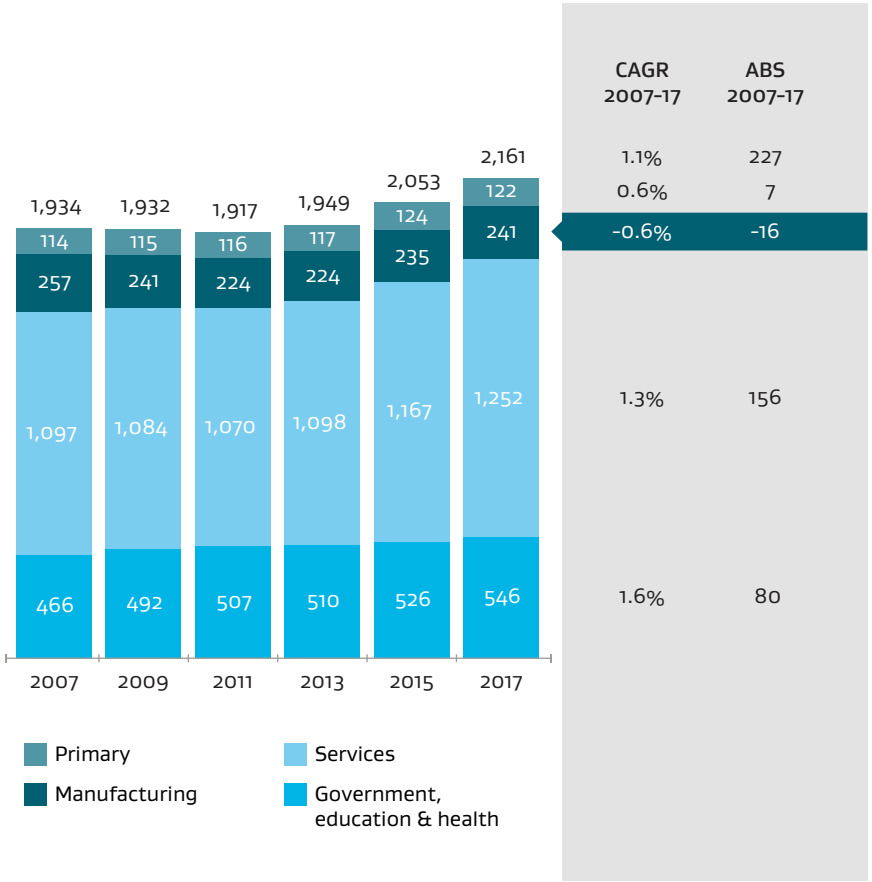
Senior executive, 'machinery and equipment' firm

"When you get to a certain critical mass, you end up having to exit a relatively high cost manufacturing environment."

Board member, 'machinery and equipment' firm

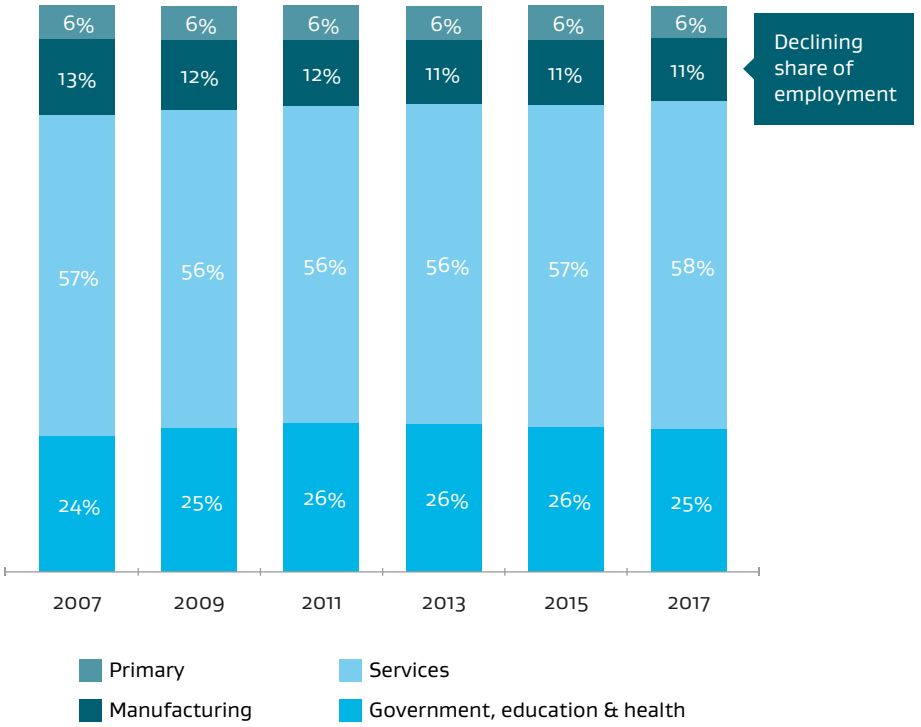
Employment growth in the ten years to 2017 has been driven mostly by services (+156,000 workers); manufacturing lost 16,000 workers in that time

Number of persons employed by major sector
Employees 000's, 2007–2017



Source: Business Demography Survey, Statistics New Zealand.

Share of persons employed by major sector
% employees, 2007–2017

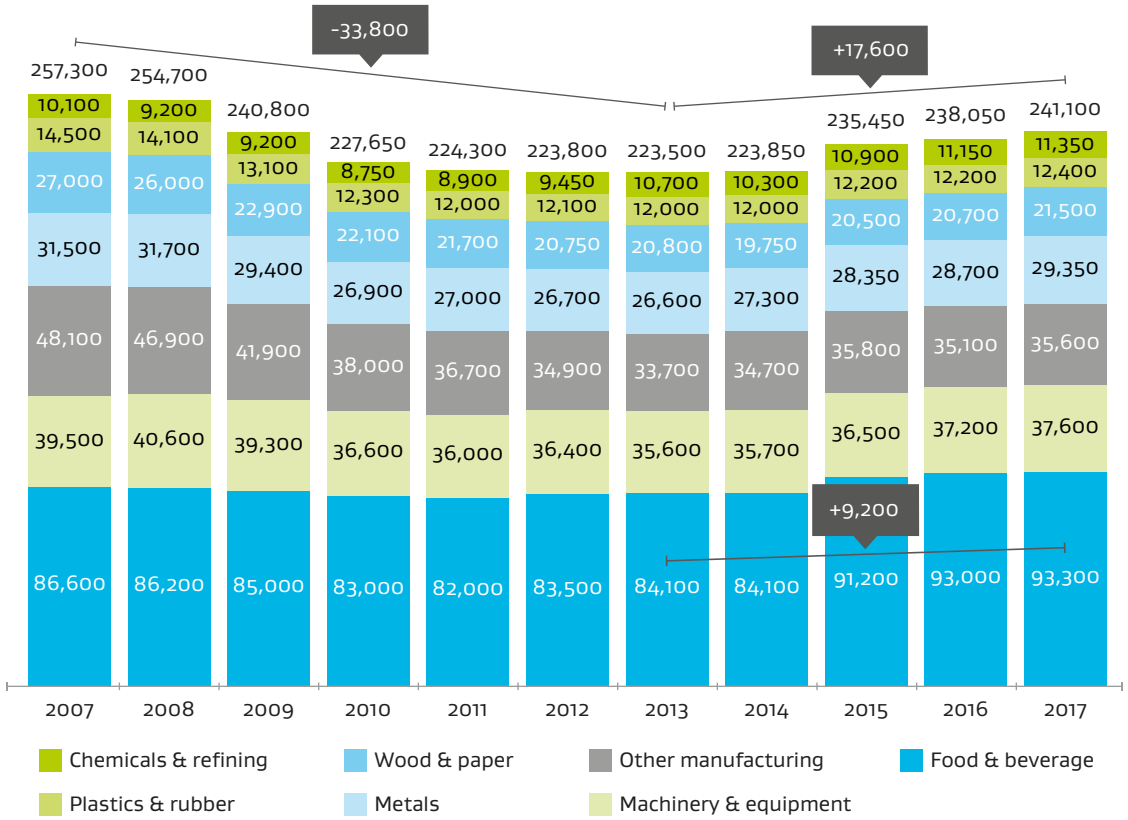


Source: Business Demography Survey, Statistics New Zealand.

Manufacturing employment has been growing since 2013, driven by the 'food and beverage' subsector

Number of employees by manufacturing subsector

Employees, 2007–2017



	CAGR 2016–17	CAGR 2007–17	ABS 2007–17
Chemicals & refining	1.3%	-0.6%	-16,200
Wood & paper	1.8%	1.2%	1,250
Other manufacturing	1.6%	-1.6%	-2,100
Plastics & rubber	3.9%	-2.3%	-5,500
Metals	2.3%	-0.7%	-2,150
Machinery & equipment	1.4%	-3%	-12,500
	1.1%	-0.5%	-1,900
Food & beverage	0.3%	0.7%	6,700

'Chemicals & refining' subsector is growing jobs

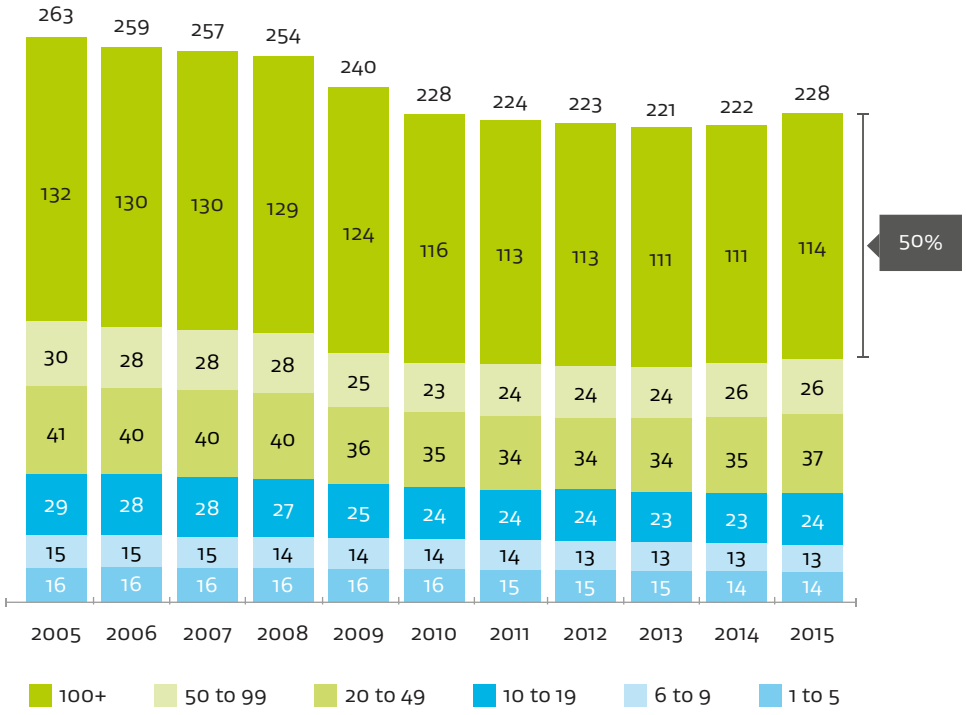
'Food & beverage' subsector is growing jobs

Source: Business Demography Survey, Statistics New Zealand.

Half of all people employed in manufacturing work in large (100+ employees) firms

Number of employees by firm size

Employees 000's, 2005–2015



	CAGR 2014-15	CAGR 2005-15	ABS 2005-15
100+	2.5%	-1.4%	-35
50 to 99	3.4%	-1.4%	-18
20 to 49	0.6%	-1.6%	-5
10 to 19	5.2%	-1%	-4
6 to 9	2.4%	-1.8%	-5
1 to 5	-4.3%	-1.8%	-3
	-1%	-1.2%	-2

Note: Totals may not match other pages due to rounding. More recent data could not be obtained due to a change in statistical methods.

Source: Business Demography Survey, Statistics New Zealand.

Case Study: New Zealand Steel

New Zealand Steel is the country's only producer of flat rolled and long formed steel products for the building, construction, manufacturing and agricultural industries. The company operates a fully integrated steel mill and uses locally sourced iron sand to produce around 650,000 tonnes of steel a year.

New Zealand Steel is constantly innovating to create products that are customised to meet New Zealand's unique geographical conditions.

New Zealand has some environmental conditions that require resilient steel products, for example high UV and wind, and salt erosion from our coastal environment. Our buildings also have more stringent earthquake standards than other markets such as Australia. The country's environment also varies significantly from north to south. New Zealand Steel manufactures steel products to meet these unique conditions. This requires a high level of complex technology, and constant innovation.

For example, New Zealand Steel's COLORSTEEL® roofing product is continually being developed to improve its durability and performance. The company has a dedicated innovation team – including two staff with PhDs in their fields – that is constantly researching and developing product.

New Zealand Steel's customised products can give them an edge in the domestic market.

The development of products to meet the unique needs of the New Zealand market, combined with the customer service they offer, enables New Zealand Steel to compete against large international manufacturers importing into New Zealand.

International manufacturers are unlikely to invest in creating unique products for the relatively small New Zealand market, and instead import generic products that they can produce at high volumes and distribute internationally. As a result, New Zealand Steel is able to compete on the quality of their product.

New Zealand Steel is vertically integrated and has a fully self-sufficient domestic supply chain.

The raw materials that New Zealand Steel requires to make its product are all available in New Zealand. This means that while New Zealand Steel is a boutique plant compared to global manufacturers, it can manufacture in New Zealand because the coal, iron ore and lime supplies are all in close proximity.

New Zealand Steel is generally able to hire skilled staff, but is also increasing automation of production, which reduces the number of staff needed.

Whilst it is becoming more of a challenge to find skilled trade workers, New Zealand Steel invests significantly in apprenticeship and graduate programmes to train and develop the skilled employees they need.

Case Study: Douglas Pharmaceuticals

Douglas Pharmaceuticals is one of the few pharmaceutical manufacturers in New Zealand and produces mainly prescription medicines for export. The company has plants in New Zealand and Fiji and exports the majority of its product to markets including the USA, Europe and Australia. Around one third of what Douglas Pharmaceuticals manufactures in New Zealand is on a third party contracting basis from larger multinationals.

Douglas Pharmaceuticals has the capability to manufacture toxic products, providing a global niche for the company.

Douglas Pharmaceuticals' facilities are equipped with containment suites with the ability to manufacture very toxic products like Cyproterone Acetate that many other pharmaceuticals companies are not able to manufacture. This is their point of difference and large, multinational pharmaceutical manufacturers seek contracts with Douglas Pharmaceuticals because of this expertise.

The manufacture of pharmaceuticals requires strict controls and meeting quality standards is essential to the company's success. The company has built an international reputation as a reliable company that can deliver high quality products. It has built long-term relationships with its customers, who trust Douglas to deliver.

Regulatory compliance and meeting international standards is an important part of the company's work.

Regulatory compliance for pharmaceuticals is different in every country. Douglas Pharmaceuticals invests significantly in having the technology and capability to meet all quality standards needed to gain access to different international markets.

R&D spending is closely linked to the need to keep up with changing international standards. For example, Douglas will invest close to $6 million in new serialisation equipment to meet new European regulations in 2018. R&D is a significant ongoing investment for the company but is an expense that is necessary to successfully compete in international markets.

Recruiting skilled staff is one of the biggest challenges Douglas Pharmaceuticals faces.

As one of the only pharmaceutical manufacturers operating in New Zealand, there is a shallow labour pool of workers with the necessary skills from which the company can draw. They recruit a number of skilled migrants to fill specific roles and also invest in training New Zealand staff.

The company has established an internship programme for young graduates. The programme will provide graduates with experience working for a pharmaceutical company, with a view to offering them permanent employment.

SECTION 4

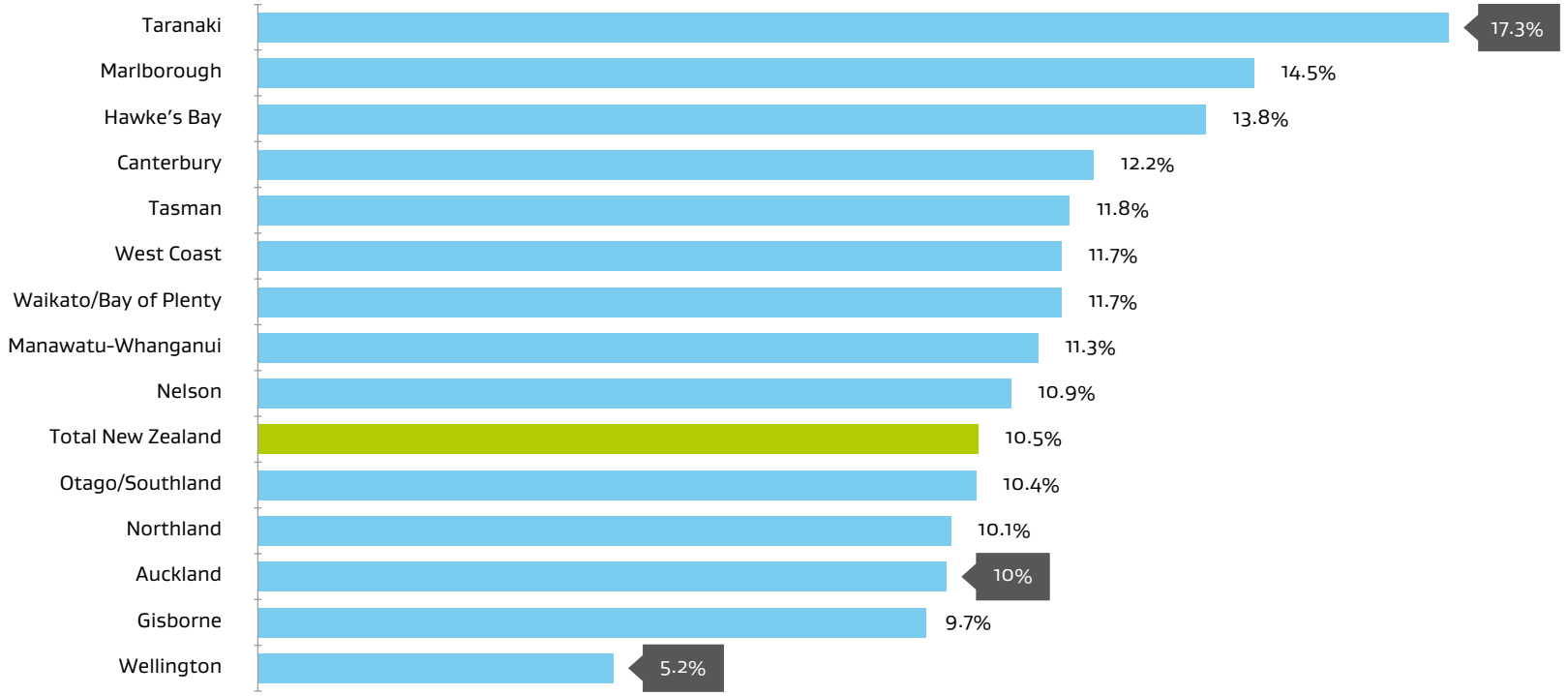
Regional employment and industry clusters

Key points

- The manufacturing sector is a key source of employment for economies outside of main population centres (Auckland and Wellington).
- Auckland is the largest region for manufacturing; it accounts for over one third of both firms and employment.
- Manufacturing employment declined in all regions except for Waikato/Bay of Plenty in the ten years to 2017; Waikato/Bay of Plenty and Auckland have shown the most employment growth in the five years to 2017.
- Different manufacturing subsectors are spread across different regions in New Zealand, for example 'machinery and equipment' manufacturing is concentrated in Auckland while 'wood and paper' manufacturing is spread across Auckland, Waikato/Bay of Plenty and Canterbury.
- There are few economically significant manufacturing clusters in New Zealand.

The manufacturing sector generally has a higher share of employment in areas outside of main population centres (Auckland and Wellington)

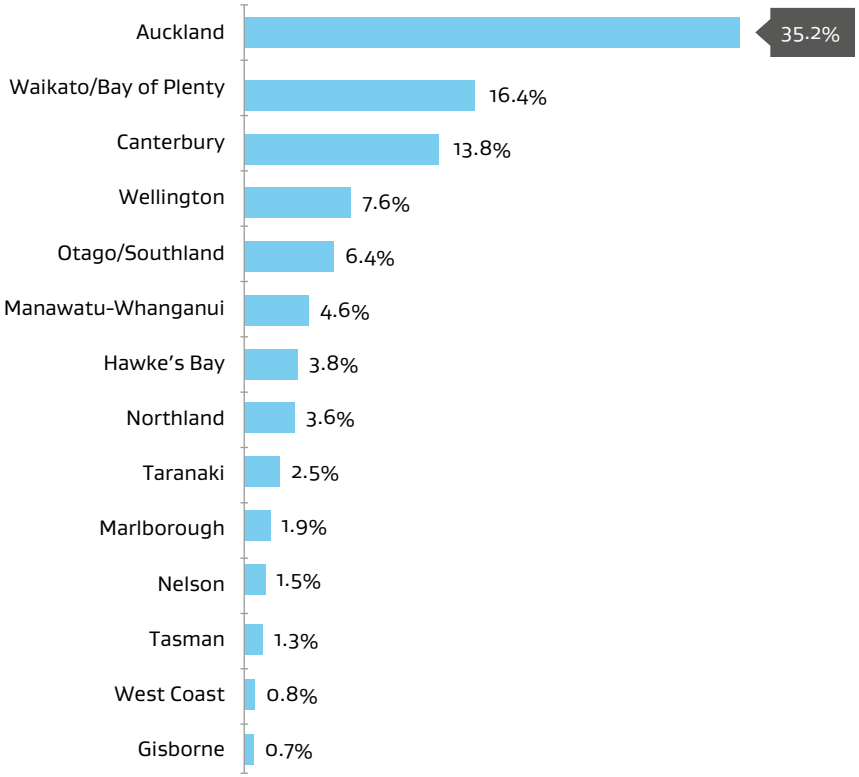
Manufacturing employment as a % of total employment by region
% employment, 2017



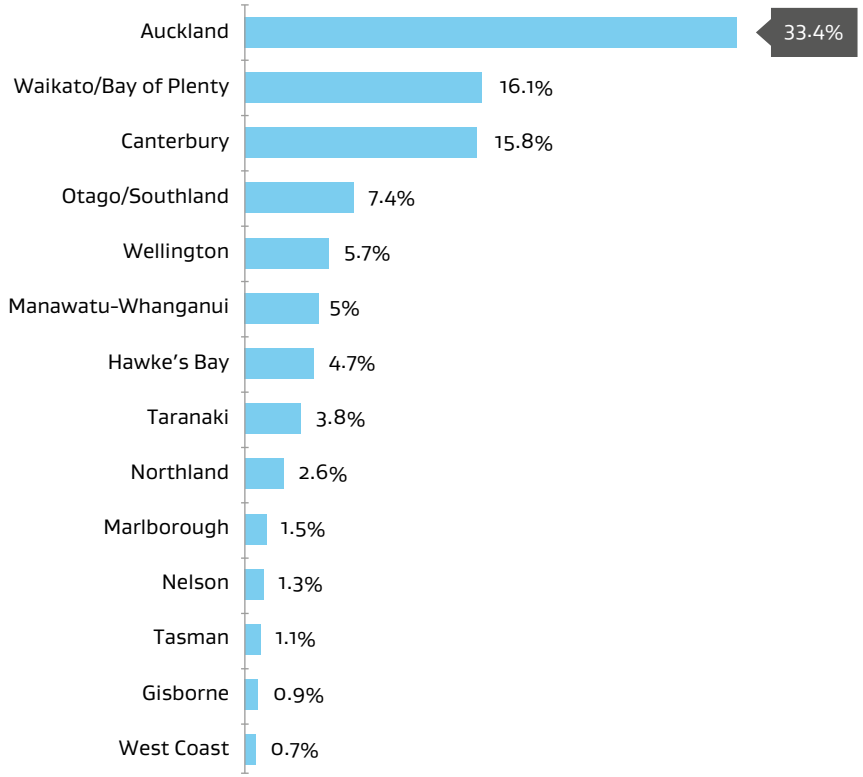
Source: Business Demography Survey, Statistics New Zealand

Auckland is the leading manufacturing region, followed by Waikato/Bay of Plenty and Canterbury

Share of manufacturing firms by region
% manufacturing firms, 2017



Share of manufacturing employment by region
% manufacturing employment, 2017



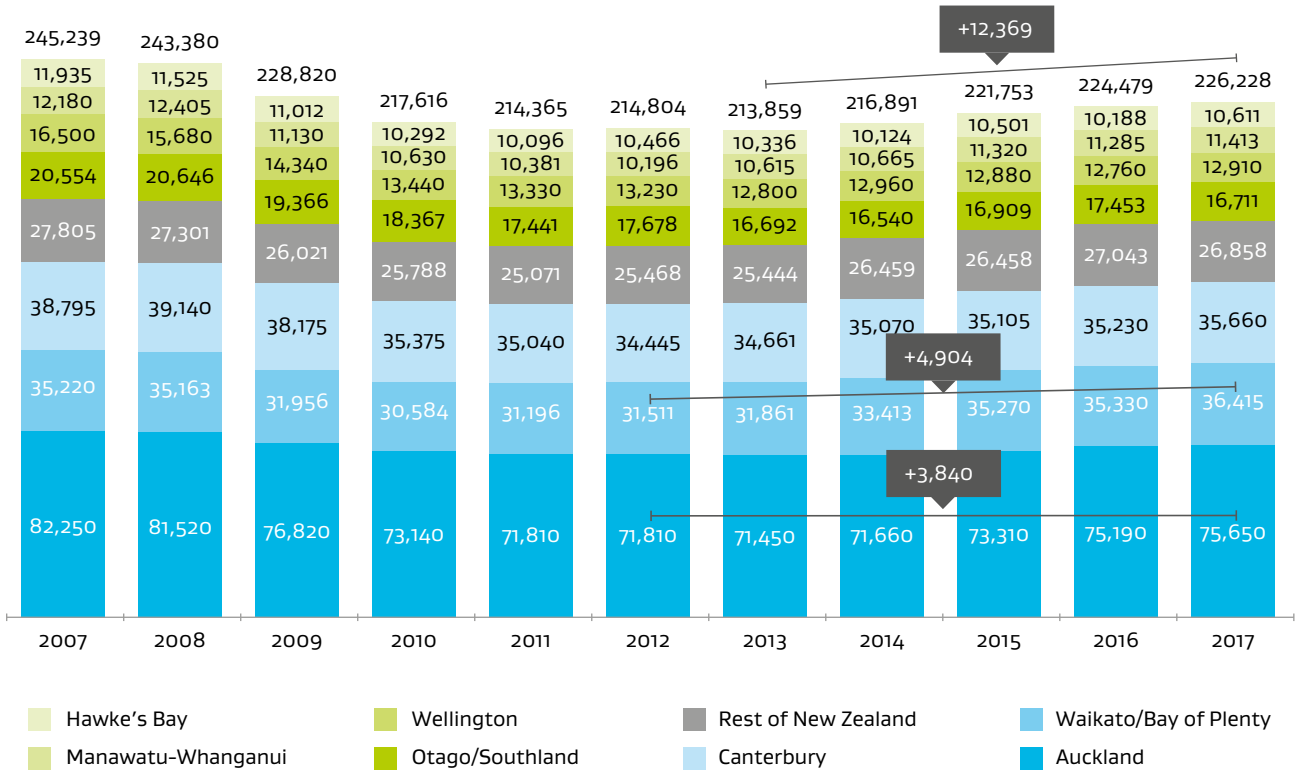
Source: Business Demography Survey, Statistics New Zealand

Manufacturing employment declined in all regions from 2007 to 2017 except for Waikato/Bay of Plenty

Waikato/Bay of Plenty (+4,904) and Auckland (+3,840) had the most employment growth in the five years to 2017

Manufacturing employment by region

Employment, 2007-2017



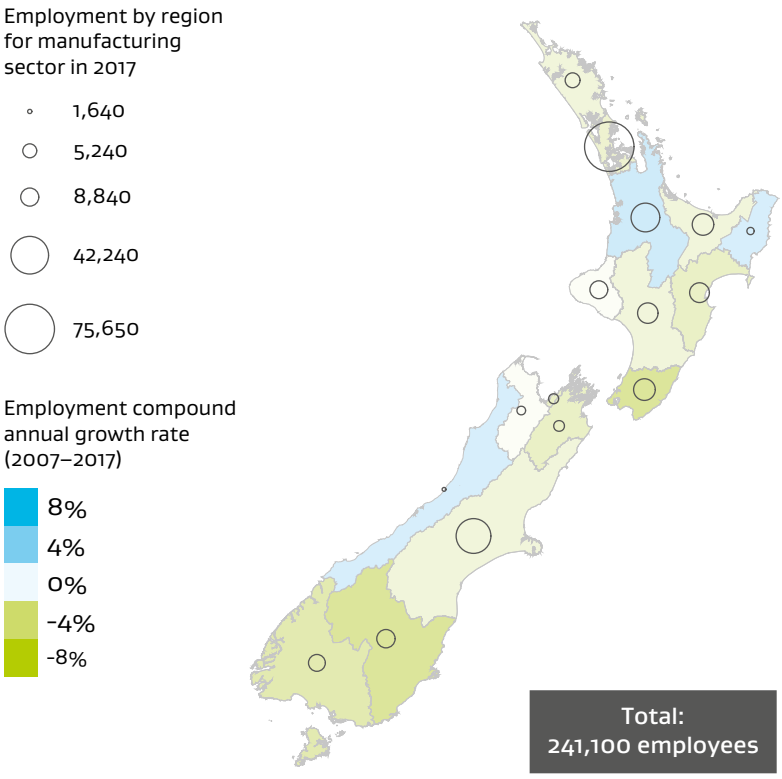
	CAGR 2016-17	CAGR 2007-17	ABS 2007-17
Hawke's Bay	0.8%	-0.8%	-19,011
Manawatu-Whanganui	4.2%	-1.2%	-1,324
Wellington	1.1%	-0.6%	-767
Otago/Southland	1.2%	-2.4%	-3,590
Rest of New Zealand	-4.3%	-2%	-3,843
Canterbury	-0.7%	-0.3%	-947
Waikato/Bay of Plenty	1.2%	-0.8%	-3,135
Auckland	3.1%	0.3%	1,195
Total	0.6%	-0.8%	-6,600

Note: Totals may differ from other graphs due to rounding

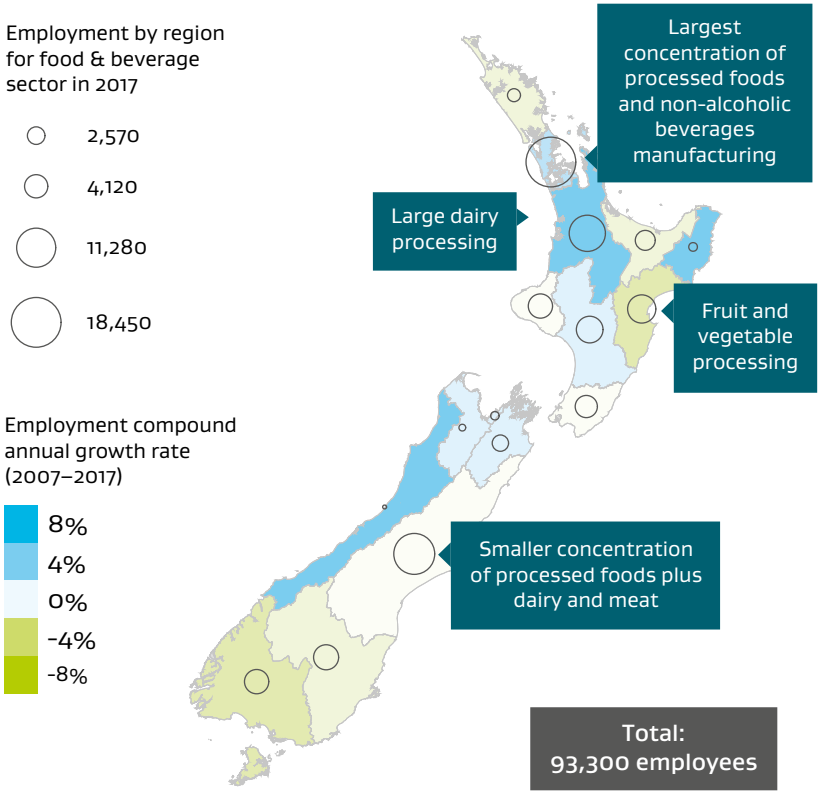
Source: Business Demography Survey, Statistics New Zealand

Auckland is the largest region for total manufacturing employment; ‘food and beverage’ manufacturing has several key regional clusters

Total manufacturing



‘Food and beverage’



Source: Business Demography Survey, Statistics New Zealand

‘Machinery and equipment’ and ‘other manufacturing’ are mostly concentrated in Auckland

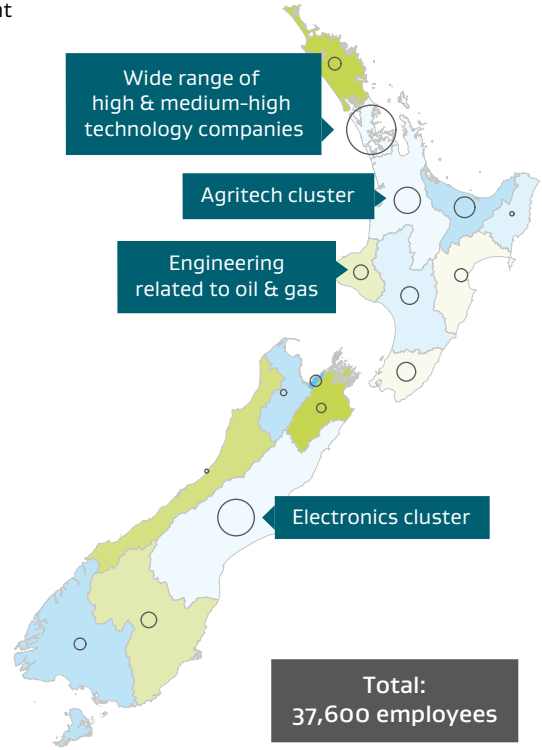
‘Machinery and equipment’

Employment by region for machinery & equipment sector in 2017

- 130
- 520
- 910
- 8,600
- 16,300

Employment compound annual growth rate (2007–2017)

- 8%
- 4%
- 0%
- -4%
- -8%



‘Other manufacturing’

Employment by region for other manufacturing sector in 2017

- 160
- 600
- 1,040
- 8,070
- 15,100

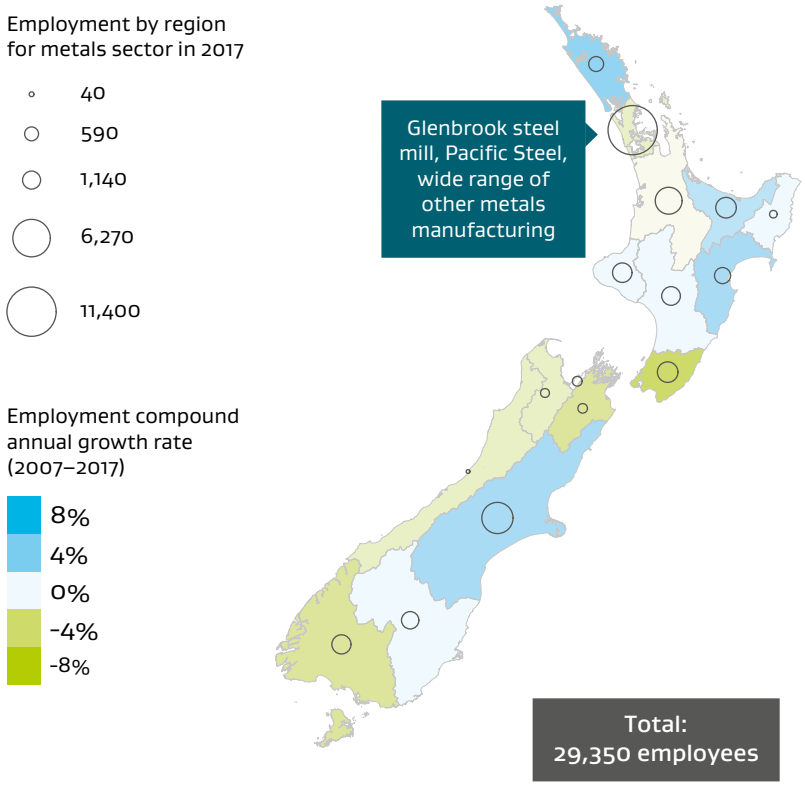
Employment compound annual growth rate (2007–2017)

- 8%
- 4%
- 0%
- -4%
- -8%

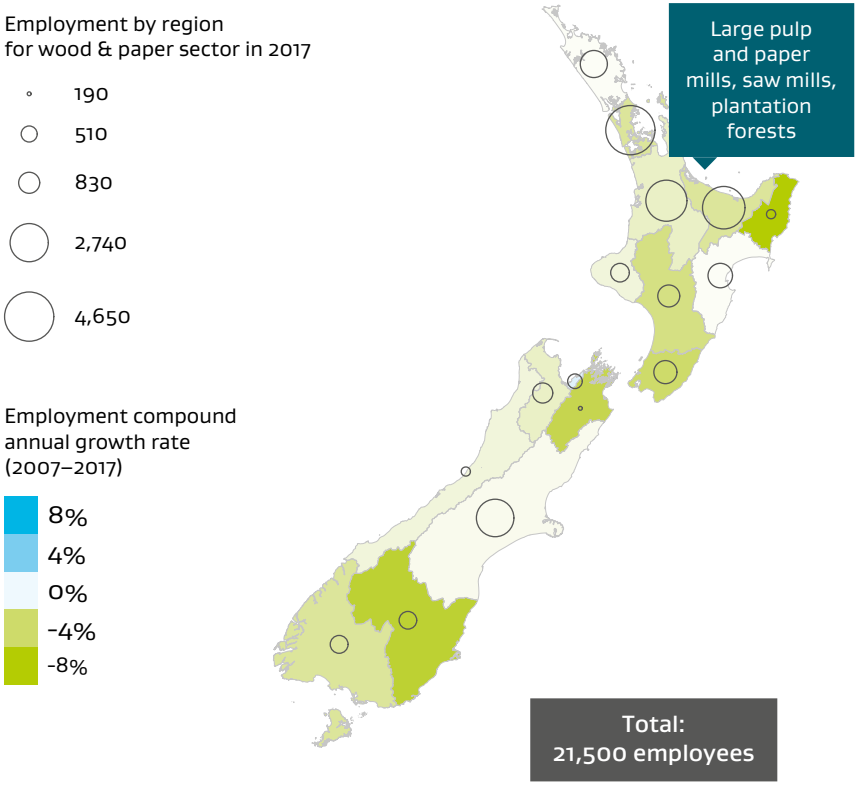
Source: Business Demography Survey, Statistics New Zealand

‘Metals’ manufacturing is concentrated in Auckland; ‘wood and paper’ manufacturing is spread across Auckland, Waikato/Bay of Plenty and Canterbury

‘Metals’



‘Wood and paper’



Source: Business Demography Survey, Statistics New Zealand

Auckland is the hub for ‘plastics and rubber’ and ‘chemicals and refining’ manufacturing

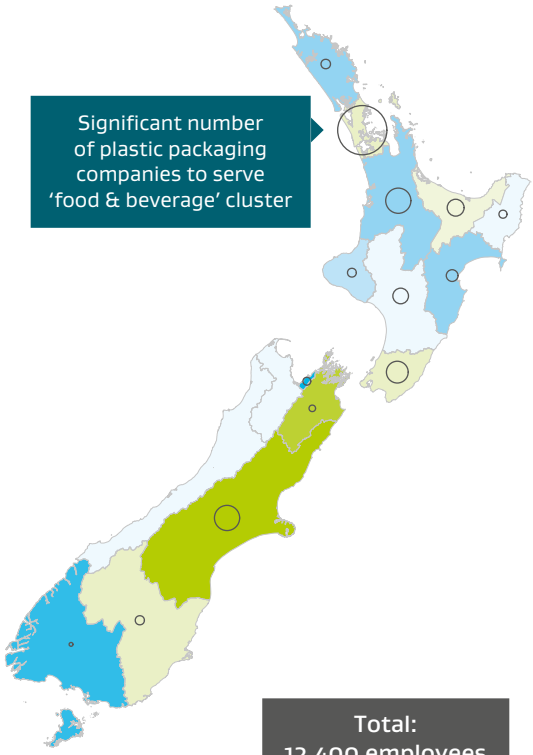
‘Plastics and rubber’

Employment by region for plastics & rubber sector in 2017

- 30
- 100
- 160
- 3,080
- 6,000

Employment compound annual growth rate (2007–2017)

- 8%
- 4%
- 0%
- -4%
- -8%



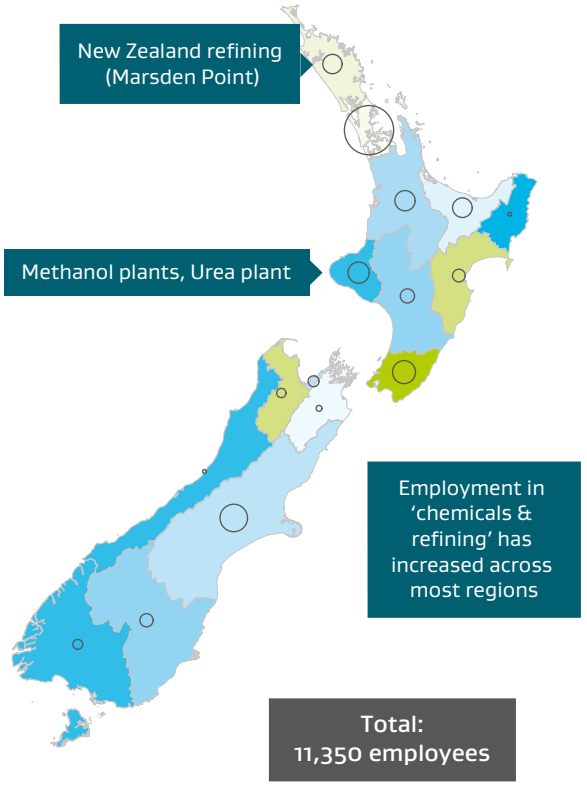
‘Chemicals and refining’

Employment by region for chemicals & refining sector in 2017

- 20
- 100
- 190
- 1,970
- 3,750

Employment compound annual growth rate (2007–2017)

- 8%
- 4%
- 0%
- -4%
- -8%



Source: Business Demography Survey, Statistics New Zealand

Case Study: Miraka

Miraka is a Māori-owned milk processing manufacturer located in Taupō. Using renewable geothermal energy and state-of-the-art manufacturing processes, Miraka has the capacity to process over 250 million litres of milk into powders and ultra-heat treated (UHT) products every year.

Miraka is guided by their strong cultural values, which have been passed down through many generations.

Miraka prides itself on the stewardship of its natural resources. They are kaitiaki (guardians) and their vision is to nurture our world. Miraka has a strong focus on land preservation, eco-friendly practices and sustainability for the future. Their sustainability initiatives include using renewable geothermal energy rather than coal to power their plant. The company treats its waste through worm farms and uses the by-product to fertilise soil for growing vegetables in local glasshouses.

Te Ara Miraka is the company's Farming Excellence Programme. It seeks to improve efficiency on farms and produce first class milk with low environmental impact. The programme provides financial incentives to its milk suppliers who work on improving animal welfare, their environmental footprint, quality assurance and staff training.

The success that Miraka has built on its core values was recognised when the company was awarded the first Māori Excellence in Export award *He kai kei aku ringa* in 2015 at the New Zealand International Business Awards. The judging panel described Miraka as a "new, innovative and exciting Māori business with Māori values and principles clearly embedded across its organisation."

The Miraka values contribute to their branding and international relationships.

The company has found that its cultural values often resonate with their consumers and can help the company build strong trading relationships. For example, in Asian markets the traditional values of consumers often align with those of Miraka. Miraka attracted the foreign investment of Vinamilk, Vietnam's largest dairy company, in 2010. Vinamilk shares many of the same values with Miraka around sustainable business practices. Miraka was Vinamilk's first investment outside of Vietnam.

Miraka produces whole milk powder and UHT milk, and is leveraging its brand to expand into more value-added products. Its Taupo Pure milk powder, branded around the story of the milk's origins in Taupō, is marketed towards busy Chinese parents who want to be able to provide safe, nutritious dairy products for their children. Taupo Pure will be sold in the New Zealand market and launched in China before the end of 2017. Miraka has also launched Whaiora, a powdered smoothie drink aimed at lifestyle consumers in New Zealand who value their health and wellness. Whaiora will also be sold in Singapore and Kuala Lumpur, key cities in South East Asia with lifestyle consumers who wish to purchase premium food products.

Recruitment is a key challenge for Miraka but the company's presence has had regional economic benefits.

The new products have resulted in more sales, marketing and innovation staff being employed by the company. Miraka notes that there are challenges with attracting staff to the Taupō region. This is largely because families often need to relocate and employees' partners may also need to find work in the region.

However the company's success in bringing skilled workers to Taupō has been a major benefit for the region – the company estimates that half of their staff were not living in the region before Miraka began production.

Case Study: XLam

XLam was founded in 2010 and is the first manufacturer of cross laminated timber in the southern hemisphere, located in Nelson. They produce large structural building panels, mainly for the New Zealand and Australian markets. Since 2012 when production commenced, XLam has experienced rapid growth. In 2015 the company was purchased by a privately owned Australian company.

XLam recently established a fully automated plant in Australia to complement their Nelson operation.

Processing at XLam's Nelson plant will remain very manual. One reason for this is that the small size of the plant cannot support the large investment in new technologies required for a greater degree of automation. Another reason is the advantage of the more manual plant allowing for a more flexible process and greater customisation of panels.

XLam's Australian plant required almost $25 million in investment and manufactured its first commercial panel in March 2018. It is on a much larger scale and is fully automated, with the ability to produce five times the volume of the Nelson plant. However, it produces simpler products in higher volumes. Nelson will continue to export premium architectural products to the Australian market, products that the Nelson plant manufactures very efficiently.

XLam invests significantly in R&D and is continually developing more efficient processes.

The company's R&D is focused on timber processing. XLam spent about $1 million in 2016 carrying out acoustic and fire tests on their structural panels to ensure they meet quality standards. The company also invests significantly in developing lean manufacturing processes in order to become more efficient.

XLam integrates services with their products to add value.

XLam provides wrap around services to meet client needs and add value to their product. This includes design, engineering and logistics services, as well as installation of products, for example installing insulation on a panel before it is delivered to site.

XLam invests significantly in its own staff training programme.

XLam recruits local staff where possible and provides training to upskill their workers. A large majority of XLam's current staff are part of the Burmese refugee community in Nelson. XLam pays for staff to complete woodworking or other training as needed.

XLam also employs a number of New Zealand carpenters, builders and other trades workers. Where necessary, they recruit immigrant workers to fill skills shortages – XLam currently employs a number of CAD designers from Europe.

XLam

Industry clusters have positive economic impacts but evolve organically and are difficult to replicate

Clusters are "geographic concentrations of industries related by knowledge, skills, inputs, demand, and/or other linkages."[1]

Clusters have a positive impact on regional and industry performance, including job creation, patenting, and new business formation. In the United Kingdom, although they made up only 8% of businesses in 2012, the top 31 clusters generated 20% of gross value added per employee on average.[2]

Motorsport valley cluster, United Kingdom

- 41,000 jobs in 2012 and £9 billion in revenue
- Hosts 8 of the world's 11 Formula 1 teams within 80 minutes drive of the Silverstone racetrack
- Full motorsport supply chain: design, manufacture, racing facilities management, R&D, training, academia, business support
- Motorsport Industry Association promotes the sector, runs networking events, works with universities for tailored courses
- Silverstone University Technical College is geared to industry needs
- Infrastructure – 2 racetracks, wind tunnels, good transport links
- Networking - weekly race meets.

http://www.centreforcities.org/wp-content/uploads/2014/07/FINAL_Centre-for-cities-report2014.pdf

In addition to the firms themselves, clusters can include:

- Suppliers of specialised inputs e.g. components, machinery, services
- Businesses or government agencies that provide specialised infrastructure
- Channels and customers in downstream industries
- Manufacturers of complementary products
- Central and local government agencies and other institutions providing training, education, research, information and technical support (often export and innovation support)
- Investors and specialist commercial service providers (e.g. technology lawyers)
- Specialist training providers and industry bodies.

Clusters form organically over time and are difficult to replicate. *"Individual companies cannot establish them on their own, while historically governments across the world have tried and failed to conjure effective clusters from nothing. Therefore, where they exist, clusters are valuable because they represent defensible advantage in a competitive, globalising world."*[3]

Local and national level governments can have a role in fostering the development of existing clusters, where industry cluster leaders and stakeholders have an appetite for this. All parties need to work closely together to identify the unique needs, and potential solutions, for any specific cluster.

1 Delgado, M, Porter M, Stern, S. (2014). Defining Clusters of Related Industries. Working paper 20375. National Bureau of Economic Research, Cambridge.

2 ibid

3 ibid

Clusters are important for competitiveness and innovation, but New Zealand has few economically significant manufacturing clusters

To be competitive, an industry requires a supporting ecosystem that provides access to a range of capabilities. Some parts of this ecosystem will be generic (e.g. property rights, regulations). Many will be specific to a particular type of industry (e.g. training, standards).

The co-location of a large number of firms producing similar or related products drives demand for the supporting capabilities in the ecosystem, and hence the ecosystem's development. Once a certain scale is reached the cluster becomes a centre of gravity and competitiveness, attractive as a place to locate, invest, innovate and start new firms. Like attracts like, and success breeds success. Firms, particularly smaller firms, derive many benefits, such as access to a larger pool of expertise, skilled labour, management capability and knowledgeable investors. This increases their ability to compete both within New Zealand and in much more difficult international markets.

Clustering is important for the development of niche oriented and innovation driven technology industries. They are also important for fast moving consumer goods manufacturers, such as consumer food and beverage, as these firms typically engage in constant innovation and new product development.

These kinds of industries require access to, and communication of, complex, non-standardized and often highly technical knowledge, and are therefore highly dependent on "face-to-face" communication.[4]

This means that, despite talk of the 'death of distance' and 'virtual clusters', actual clusters are all about physical proximity. Proximity allows for serendipity and cross-fertilisation in innovation and R&D, increases the spill-over of knowledge and ideas from one firm to another and enables collaboration between firms and their suppliers and advisors.

The small size of our economy and our firms, together with the country's large geographical area, make it challenging to develop industry clusters of international scale. Some New Zealand firms will manufacture offshore to access the benefits of large-scale international clusters that are not present in New Zealand.

Even when New Zealand has an industry with high competencies and an international profile, it tends to be dispersed across different locations. For example, New Zealand's marine industry is 'centred' in Tauranga, Auckland and Northland.

Food and beverage manufacturing in Auckland is the largest manufacturing cluster in New Zealand, with a mix of multinationals, large and small firms and a well-developed ecosystem. In international terms, it is at a scale that ticks nearly all the 'cluster' boxes.

In most other cases, it is more realistic to think of New Zealand's clusters as emerging or 'micro-clusters', when compared to international peers. Nevertheless, there is considerable development potential in these concentrations of industries. Encouragingly, New Zealand was ranked 44 for cluster development in the Global Competitiveness Report 2017/18, up from 64 in 2012/13.

> "When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously."
>
> *Principles of Economics by Alfred Marshall (1890)*

4 McCann, P. (2003). Geography, Trade and Growth: Problems and Possibilities for the New Zealand Economy. *New Zealand Treasury Working Paper, 03* (03) Retrieved from: http://www.treasury.govt.nz/publications/research-policy/wp

Auckland's food and beverage industry has all the hallmarks of an internationally significant cluster

Auckland food and beverage manufacturing cluster	
Concentration of firms	One third (1,395) of all NZ's food & beverage manufacturing firms in 2017.
Concentration of jobs	18,450 food & beverage employees in 2017 – 23% of NZ's total food & beverage workers.
Head offices	Head offices of 50 of the 100 largest NZ F&B firms, including Fonterra (c. 1,500 people in Auckland head office).
Multinational firms	Thirty multi-nationals, or multi-national owned, including Goodman Fielder, Heinz Wattie's, Lion, Coca-cola Amatil, Heineken, Frucor, Nestle NZ, Independent Liquor, Danone, Nutricia, Griffin's Foods, Mondalez NZ.
Large anchor firms	As above and including Fonterra (22,000 staff globally); Sealord (1,500 staff globally); Sanitarium (350 staff); Wilson Hellaby (700 staff).
Science and education institutes	Auckland University, Massey University, Unitec, Manukau Institute of Technology, Crown Research Institutes.
Innovation infrastructure	FoodBowl, part of the New Zealand Food Innovation Network.
Upstream and downstream industries	Packaging, printing, logistics, design, warehousing, marketing, cool stores, equipment manufacturing, sophisticated restaurant sector.
Other factors	Access to international and domestic air and shipping links, NZ's largest and most diverse domestic regional market, international linkages.
Cluster organisation and branding	No cluster organisation or branding.

Canterbury has a long history in technology, particularly electronics manufacturing

Canterbury electronics manufacturing cluster (tech sector)	
Concentration of firms	102 electronics and electrical manufacturing firms in 2017 – 18% of the NZ total of 576.
Concentration of jobs	2,013 electronics and electrical manufacturing employees in 2017 – one third of NZ's total of 6,385.
Head offices	Tait Communications, Enatel, DesignA Electronics, Salcom, ELMG, Solar Bright.
Multinational firms	Trimble (250 people), Dynamic Controls, Eaton (R&D only), TE Connectivity (100 people), AuCom, Enphase Energy, GPC Electronics.
Large anchor firms	Tait Communications employs 650+ people globally, exporting 95% of products from Christchurch; Enatel and divisions Enasolar and Motive Power.
Science and education institutes	University of Canterbury, NZi3 (National ICT Innovation Institute), HITLab, Ara Institute.
Innovation infrastructure	Tait Technology Centre, Innovation precinct, Ministry of Awesome, Innovation Map.
Upstream and downstream industries	Software, logistics, design, marketing, machinery & equipment, components.
Other factors	Access to international and domestic air and shipping links, active industry networks (Canterbury Tech Cluster), annual Tech Summit, base for NZ Manufacturers Network.
Cluster organisation and branding	Yes: http://canterburytech.nz/

SECTION 5

Labour market and skills

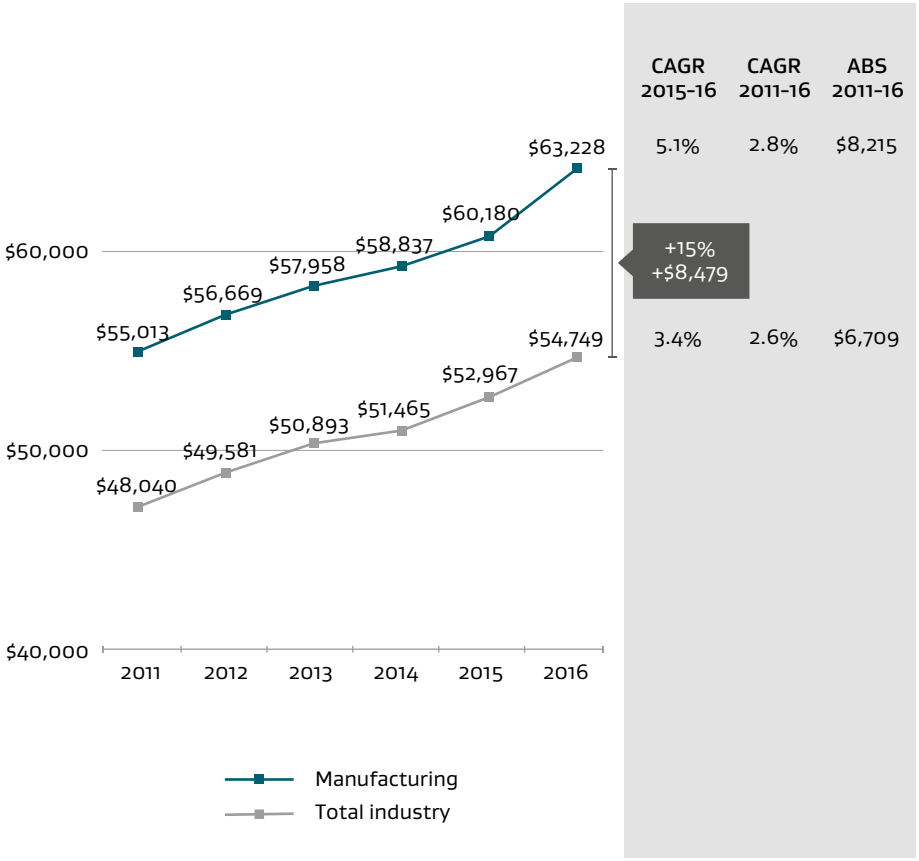
Labour market and skills: Key points

- Manufacturing sector annual wages are 15% higher than the New Zealand average, partially driven by employees in the manufacturing sector working more hours per week than employees in other sectors.
- Manufacturing firms struggle to recruit enough tradespeople and have slightly more hard to fill vacancies than other sectors.
- Over half of manufacturing related education is at certificate levels 3 and 4 (the level of most trade-related qualifications); 5% of tertiary graduates in 2015 studied a field closely related to manufacturing.
- The number of graduates, trainees and apprentices in manufacturing related fields has increased since 2011.
- Work visa numbers for potential manufacturing employees have more than doubled in the last five years.

Annual manufacturing wages are 15% higher than the New Zealand average

Average salary/wages

NZ$, 2011–2016



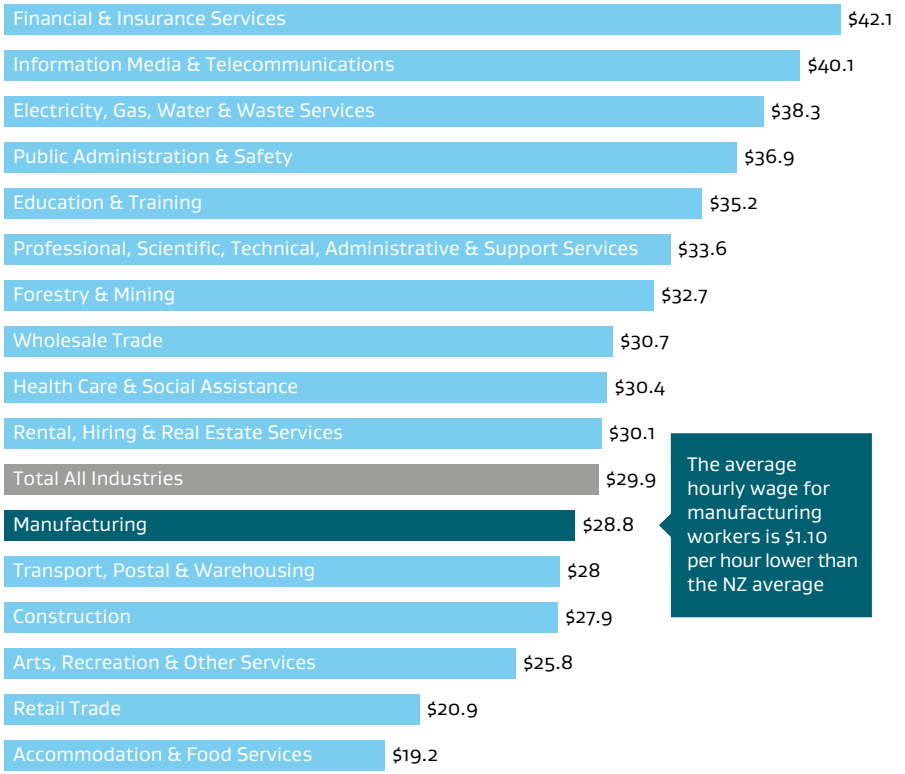
Note: Average wage is calculated by total salaries & wages paid, divided by number of employees.

Source: Annual Enterprise Survey, Statistics New Zealand, MBIE analysis.

However, average hourly wages for manufacturing workers are lower than the New Zealand average

Average hourly earnings per employee

NZ$, year ended June 2017

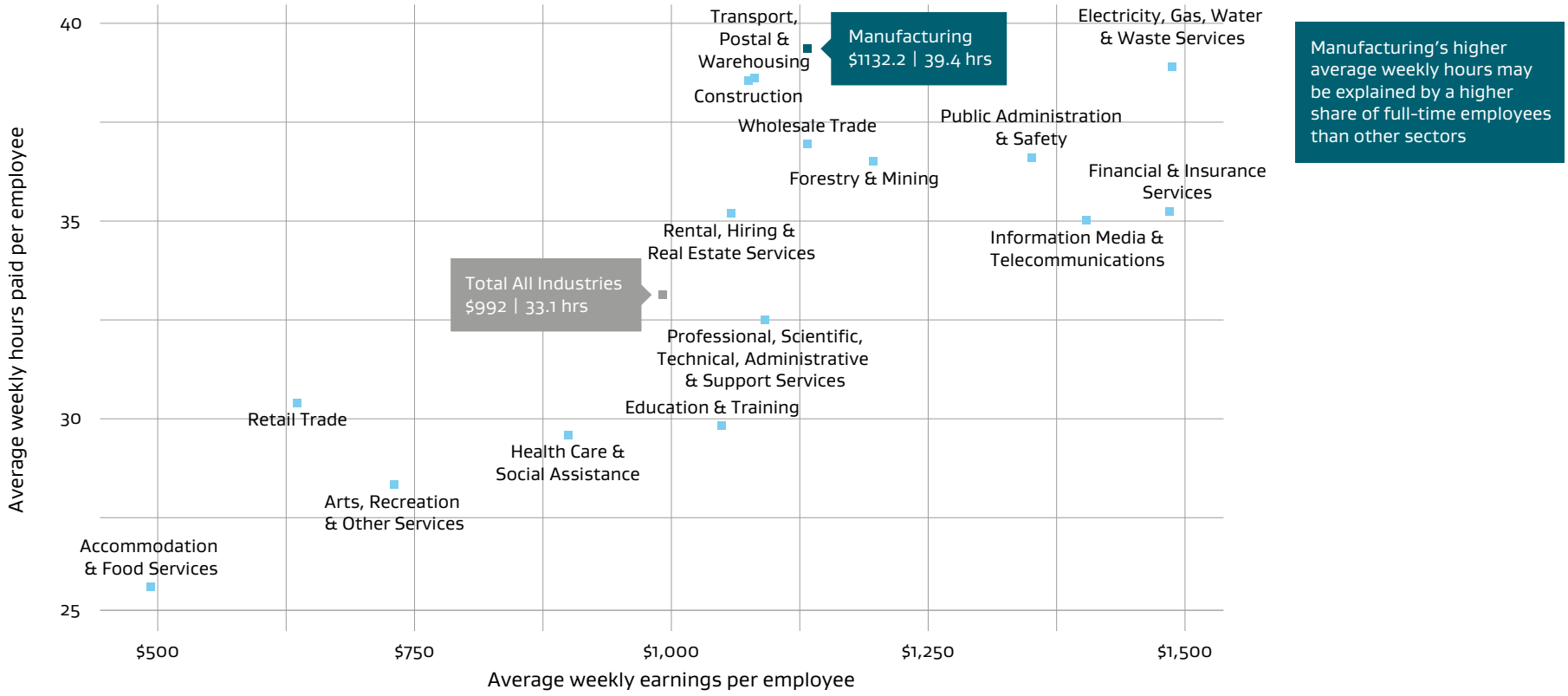


Source: Quarterly Employment Survey, Statistics New Zealand.

Manufacturing employees on average work more hours each week than employees in any other sector

Average weekly earnings and hours worked

NZ$; hours, year ended June 2017

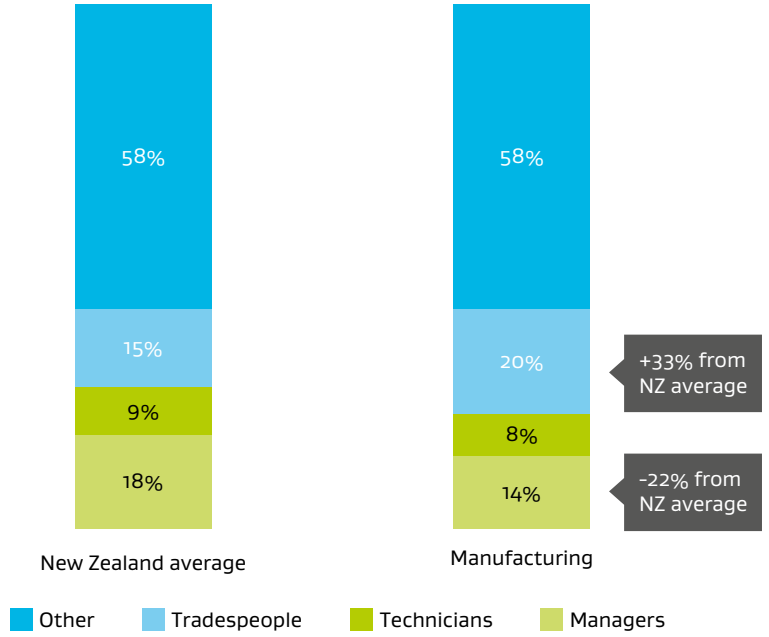


Manufacturing's higher average weekly hours may be explained by a higher share of full-time employees than other sectors

Source: Quarterly Employment Survey, Statistics New Zealand.

Manufacturing employs more tradespeople and fewer managers than other sectors

Workforce by occupational group
% workforce, 2016



Note: 'other' employees include clerical, sales and service workers; production and transport workers; labourers and related workers who perform routine tasks, either manually or using equipment; and all other occupations.

Source: Business Operations Survey, Statistics New Zealand.

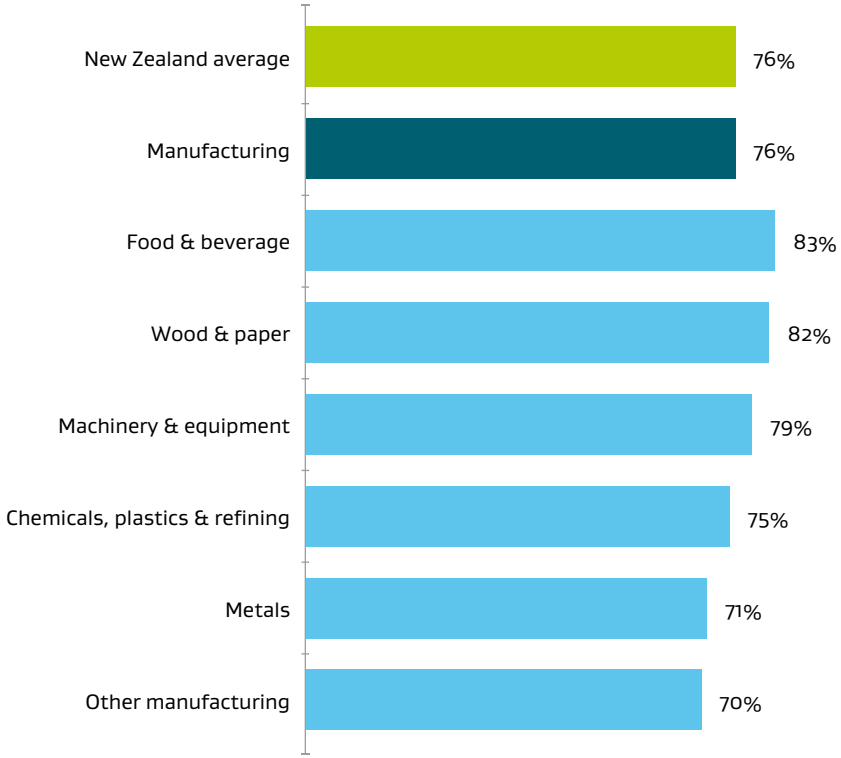
Manufacturing firms find it harder than New Zealand firms generally to recruit tradespeople

Vacancies by hard to find skills
% firms, 2016

Source: Business Operations Survey, Statistics New Zealand.

Overall, manufacturing firms report a similar number of vacancies to the New Zealand average

Firms reporting a vacancy in the last year
% firms (selected sectors), 2016

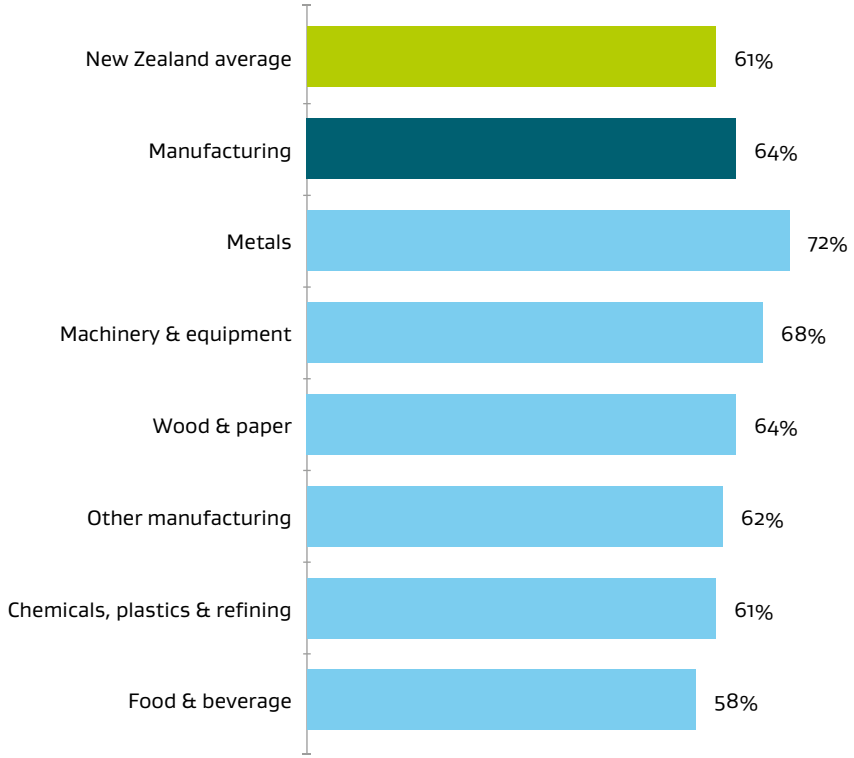


Note: Due to data limitations, 'chemicals and refining' and 'plastics and rubber' are shown as one subsector – 'Chemicals, plastics and refining'.

Source: Business Operations Survey, Statistics New Zealand.

But manufacturing firms report marginally more *hard to fill* vacancies than the New Zealand average

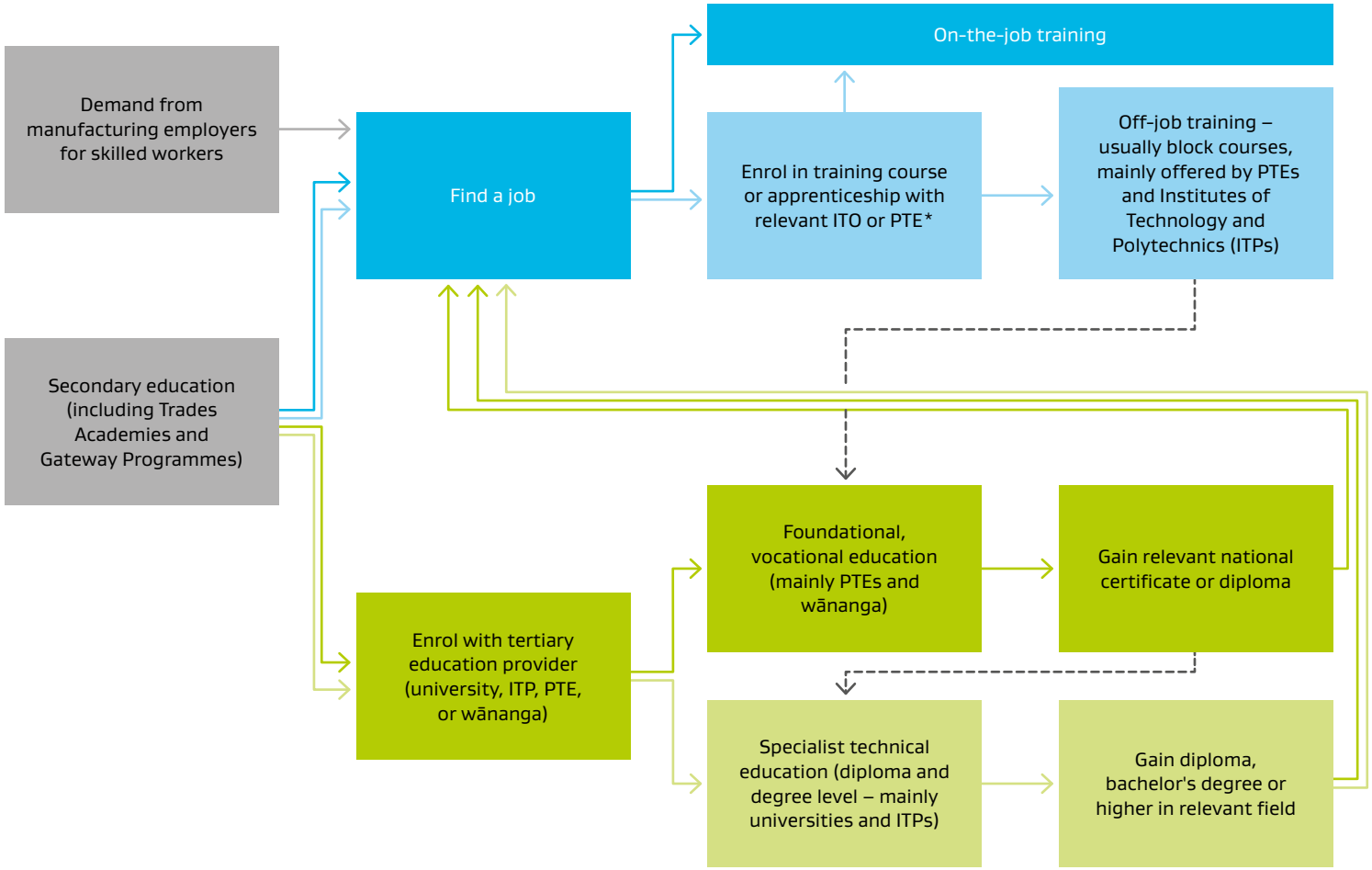
Firms reporting *hard to fill* vacancies
% firms, 2016



Note: Due to data limitations, 'chemicals and refining' and 'plastics and rubber' are shown as one subsector – 'Chemicals, plastics and refining'.

Source: Business Operations Survey, Statistics New Zealand.

There are several possible training pathways to employment in the manufacturing sector



Possible training pathways to employment in the manufacturing sector:

- On-the-job training
- Apprenticeship
- Diploma or national certificate
- Bachelor's degree or higher
- Optional further training

***Examples of New Zealand Industry Training Organisations (ITOs) and Private Training Establishments (PTEs) for the manufacturing sector**

ITOs:

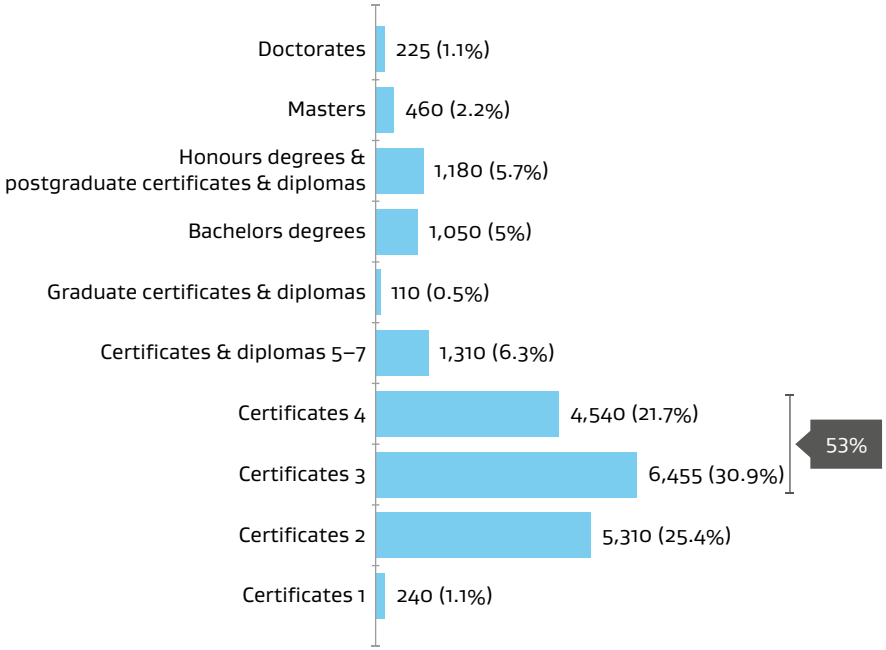
- Competenz
- MITO
- NZ Marine and Composites ITO
- Primary ITO
- The Skills Organisation

PTEs:

- Skills Update Training Institute
- New Zealand Welding School
- New Zealand Institute of Fashion Technology

53% of manufacturing related education is in certificate levels 3–4 (the level of most trade-related qualifications)

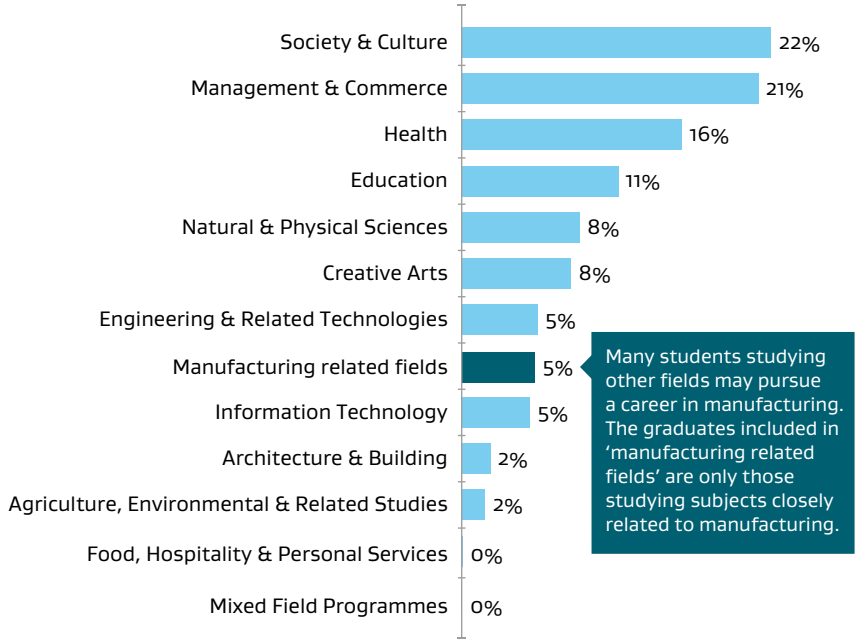
Manufacturing related qualifications earned by graduates, trainees and apprentices by level
Number of qualifications, 2015



Source: Education Counts, Field of specialisation for students gaining qualifications from tertiary education providers; Field of specialisation for industry training learners gaining qualifications.

5% of tertiary graduates in 2015 studied a field closely related to manufacturing

Tertiary graduates by predominant field of study
% graduates, 2015



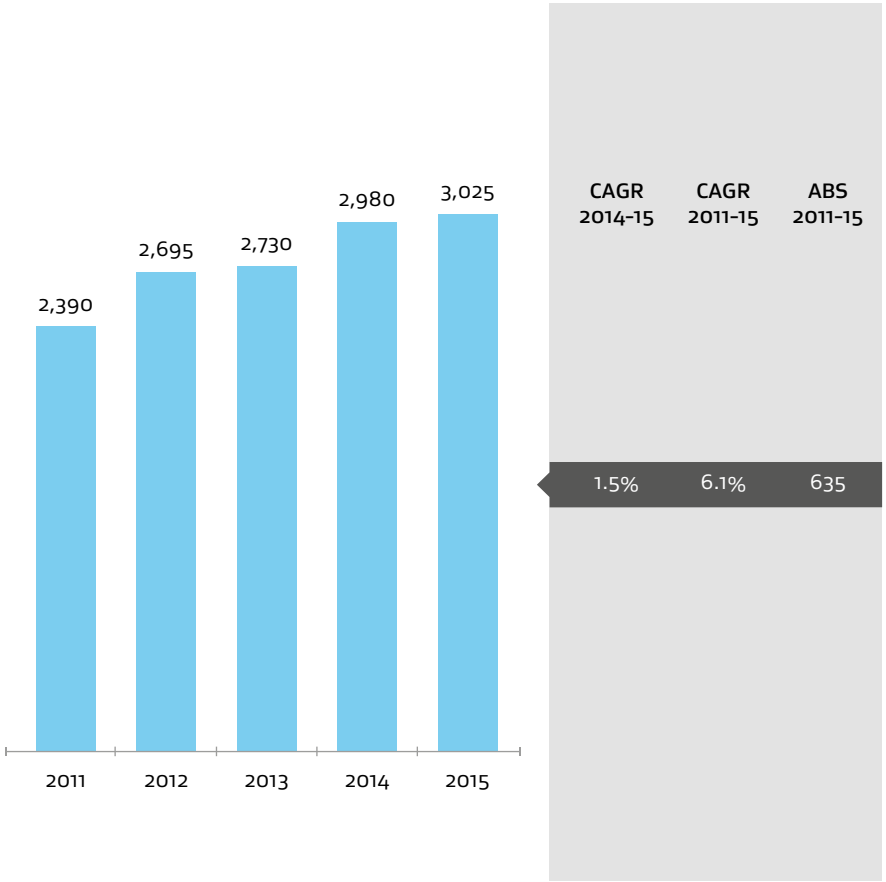
Note: Manufacturing related fields include chemical sciences; manufacturing; engineering and technology; process and resources engineering; automotive engineering and technology; mechanical and industrial engineering and technology; electrical and electronics engineering and technology; aerospace engineering and technology; maritime engineering and technology; and other engineering and related technologies. Manufacturing related graduates will be shown in both manufacturing related fields, and the specific field of their studies.

Source: Education Counts, Field of specialisation for students gaining qualifications from tertiary education providers.

The number of graduates, trainees and apprentices in manufacturing related fields has increased since 2011

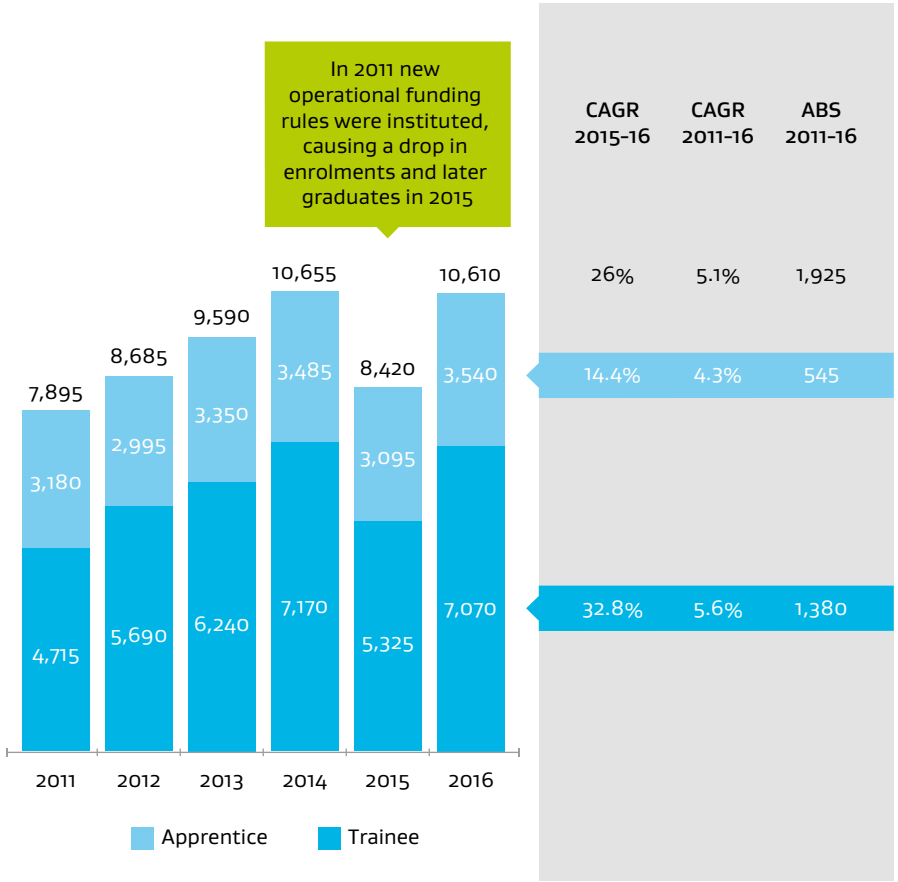
Manufacturing related tertiary graduates

Number of tertiary graduates, 2011–2015



Manufacturing related apprentices and trainees

Number of apprentice and trainee qualification earners, 2011–2016



Note: Tertiary graduate numbers for 2016 were unavailable.

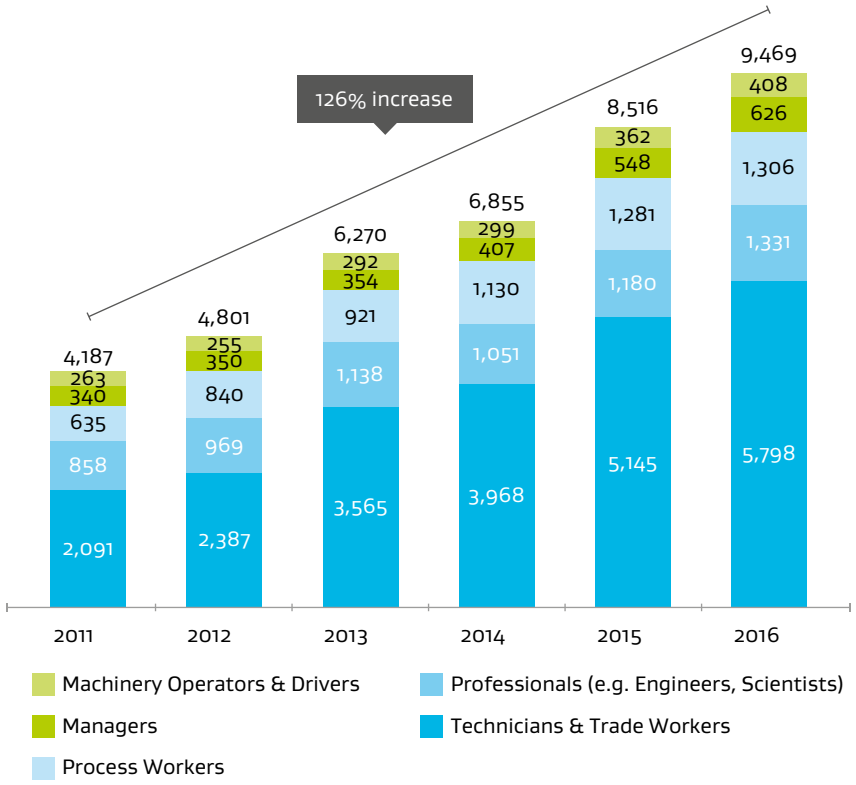
Source: Education Counts, Field of specialisation for students gaining qualifications from tertiary education providers.

Source: Education Counts, Achievement in industry training.

International recruitment has increased to fill skills shortages; work visas for potential manufacturing workers have more than doubled in five years

Work visas approved for manufacturing related occupations

Number of approved work visas, 2011–2016



	CAGR 2015-16	CAGR 2011-16	ABS 2011-16
Machinery Operators & Drivers	11.2%	17.7%	5,282
Managers	12.7%	9.2%	145
Professionals (e.g. Engineers, Scientists)	14.2%	13%	286
Technicians & Trade Workers	2%	15.5%	671
Process Workers	12.8%	9.2%	473
Total	**12.7%**	**22.6%**	**3,707**

Not all immigrants will work in manufacturing. Work visa numbers calculated are based on occupations which are primarily found in the manufacturing sector.

Note: Includes Group Visas, Permits and Visas; includes renewal of visas.

Source: Immigration New Zealand.

Industry commented on the availability of manufacturing skills in New Zealand

"Recruitment is our largest issue at the moment and also we have to employ a large number of migrants. . .we can't tap into an existing labour pool of trained people so we have to either get immigrants or train people ourselves."

Senior executive, 'chemicals and refining' firm

"All of the workers that we used to have that were amazing machinists and those sorts of things are now either retired or doing something in a completely different field and it's not in New Zealand anymore."

Chief executive, 'other manufacturing' firm

"We're quite lucky because we have really highly skilled people here. It is harder to get that kind of speciality, but I guess you can get anything if you pay for it at the end of the day."

Founder, 'chemicals and refining' firm

"Overseas we can find an accountant who has majored in manufacturing because it's such a key part of most of the other European economies."

Board member, 'machinery and equipment' firm

"It's a high unit labour cost therefore we've invested in automation over a number of years. As you get fewer roles the roles actually become more complex and more highly skilled because you are often asking people to do multiple functions."

Senior executive, 'metals' firm

"If you've got the right attitude, I'll teach you what the skills are."

Operations manager, 'other manufacturing' firm

Case Study: Soar Print

Soar Print is a printing manufacturer based in Auckland. The company has seen major changes in the print industry since its establishment in 1920. It has remained successful by shifting away from traditional print products and focusing on more bespoke, niche products.

Increasing digitisation and automation have changed the way Soar Print operates and the products it manufactures.

As the internet has changed the way we communicate, traditional print products such as advertising and newspapers have shifted online. Soar Print has kept up with the change in its industry and a greater proportion of the company's product range now centres on packaging and labels for 'food and beverage' manufacturers.

Soar Print manufactures a high number of bespoke products with short print runs. An increasing use of technology and automation has allowed the company to become more agile, in order to compete successfully in New Zealand's small but varied market.

For example, the company receives around 40 per cent of their orders online. Computer integrated machines can receive orders digitally, reducing the 'make ready' times of traditional printing.

There are advantages to being located in New Zealand, but Soar Print notes the challenge of increasing offshoring by other manufacturers.

Being located in New Zealand is an advantage for access to the New Zealand market. Soar Print remains highly competitive against international print manufacturers because a lot of print manufacturing is just-in-time, short runs where it is an advantage to be in close proximity to customers.

However, Soar Print has found the increasing outsourcing of manufacturing to low-cost countries such as China to be a challenge, due to the interdependencies of the manufacturing sector. When companies manufacture their products offshore, they do any associated printing there as well. The more that New Zealand manufacturing goes offshore, the more demand for printing diminishes as well.

Some trades workers can be hard to recruit, but younger workers are in demand for their digital skills.

Soar doesn't find it too difficult to hire skilled staff, and finds younger workers easy to train to use increasingly digitised machines. Some skills associated with finishing, such as folding and cutting which use older, more mechanical machines, are harder to recruit for.

Young people coming out of media design school are often interested in entering the print industry. Soar Print trains its own apprentices – they currently have four apprentices and around another ten workers who first entered the company through the apprenticeship programme. Soar employs a total of around 100 employees.

Soar Print has an increasing focus on sustainability.

Sustainability is a big focus for Soar Print. The company is carbon neutral and finds that this is good for business. An emphasis on sustainability is also increasingly demanded by customers. Soar Print uses Forestry Stewardship Council (FSC) accredited paper and vegetable based inks rather than mineral based inks.

Case Study: Alto Packaging

Alto is one of New Zealand's leading rigid plastics packaging manufacturers, operating in New Zealand for over 62 years. Alto has eight plants in New Zealand and largely services the 'food and beverage' industry.

Alto sees innovation as a critical way to remain competitive in the manufacturing sector.

The company works with customers to create innovative packaging that will add value and give customers an edge in the market. For example, Alto produces packaging for baby formula that includes spoons and tamper evident closures.

Alto also constantly innovates to improve the quality of their products and reduce the amount of plastic used, in order to reduce cost and become more sustainable.

Alto sees an increased drive for sustainability as an opportunity for the business.

Alto owns a large and successful recycling business in Auckland, which converts used plastic back to pellets. An increasing focus on sustainability also provides opportunities for the company to expand into new product ranges. Alto produces a significant volume of recyclable rigid plastic meat trays, made with recycled product, that have largely replaced foam meat trays in supermarkets.

Alto is focused on meeting the opportunities and challenges of manufacturing in New Zealand.

Alto feels that there are advantages to operating in New Zealand, such as the stable economy. The company also has a diverse product range which allows them to maintain a stable revenue base even if demand changes in the various sectors that they supply.

A challenge that Alto is facing is increasing pressure from large, multinational manufacturers importing into New Zealand. However, Alto's constant innovation and proximity to customers can give them an edge in the market. Alto exports 20 to 25 per cent of their product, mainly to Australia.

Alto is creating an apprenticeship programme to help them fill skills shortages.

Alto employs around 850 staff and notes that it can be challenging to find skilled staff, particularly trades workers such as fitters and plastic technicians. To address this issue, the company is in the process of building an apprenticeship programme to train workers with the skills Alto needs. This includes working with local schools to highlight career options in manufacturing and encourage school leavers to take up apprenticeships with the company.

SECTION 6

Innovation and R&D

Innovation and R&D: Key points

- In 2016 New Zealand's total business expenditure on research and development (BERD) was $1.6 billion, of which manufacturing accounted for 42% or $671 million.
- Total manufacturing BERD has grown at a CAGR of 5.4% in the eight years to 2016.
- Total BERD by 'machinery and equipment' firms in 2016 was $392m, or 58% of all manufacturing BERD, up from $195m in 2008, (44% of all manufacturing BERD).
- 'Chemicals and refining', 'plastics and rubber', 'food and beverage' and 'machinery and equipment' manufacturing stand out for the high percentage of firms undertaking both innovation and R&D.
- Manufacturing sectors producing low technology goods such as food and beverage, wood and paper, printing and publishing, make up a significant share of manufacturing in all developed economies, but the share of these industries in New Zealand is larger than most.
- There is an increasing focus internationally on the development potential that low technology industries in advanced economies offer.
- Innovation does not necessarily begin with R&D activities centred on scientific knowledge, but may be driven by problems in the production process, or by market demands.
- Growth in low technology industries generates demand for inputs from high technology industries and indirectly drives growth in R&D.

Innovation and R&D are related but different concepts; manufacturing firms both innovate (defined below) and undertake R&D

Innovation is how firms become more competitive and efficient. It is a driver of economic growth and productivity. Firms innovate by creating, adopting and adapting knowledge into new or improved design, marketing methods, business models, processes, products or services.

The **measured innovation rate** is the percentage of firms in a sector that undertook any activity during the last two financial years that resulted in the development or introduction of something new or significantly improved. This is a different measure from expenditure on innovation.

Measured innovation activity	Definition of this type of innovation	Examples
Goods or services	Significant changes in or introduction of new goods or services – this does not include selling new goods or services wholly produced and developed by other firms.	Lewis Road Creamery adding ice-cream and sour cream to their existing milk range.
Operational processes	Methods of producing or distributing goods or services.	New machines used in manufacturing, e.g. new technology developed by Fonterra to produce natural mozzarella cheese at scale and in six hours, as opposed to three months.
Organisational or managerial	Significant changes in the firm's strategies, structures or routines.	Manufacturers developing services or software around their products.
Marketing method	Includes sales and marketing methods intended to increase the appeal of goods or services for specific market segments, or to gain entry to new markets.	Whittaker's use of a 1950s style pop-up café to promote their new K Bar chocolate.

Innovation and R&D are related but different concepts; manufacturing firms both innovate and undertake R&D (defined below)

Research is defined as original and planned investigation, undertaken with the prospect of gaining new knowledge and understanding. **Development** is defined as the application of research findings or other knowledge to the production of new or substantially improved materials, devices, products, processes, systems or services.

The **measured R&D rate** is the percentage of firms in a sector that undertook any R&D activity. R&D covers any activity characterised by originality. It should have investigation as its primary objective, and have an outcome of gaining new knowledge and/or new or improved materials, products, services or processes. Buying technical knowledge or information from abroad is included. Market research, efficiency studies, and style changes to existing products are not included. The R&D rate is a different measure from business or government expenditure on R&D.

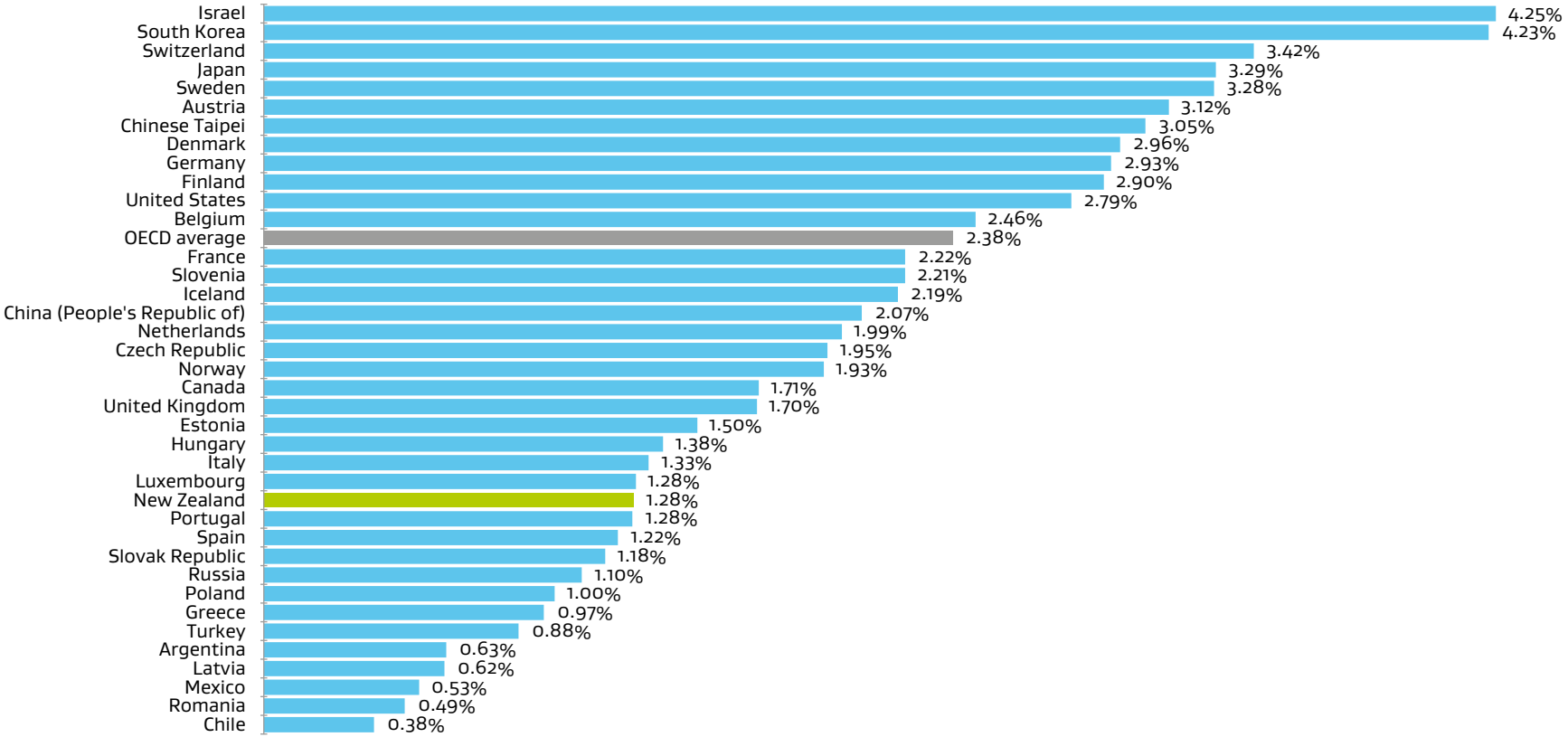
Measured R&D activity	Definition of this type of R&D	Examples
Experimental development	Systematic work, drawing on knowledge gained from research and practical experience that is directed at producing new materials, products and devices; installing new processes, systems and services; or improving substantially those already produced or installed.	Development and commercialisation of products for wound and tissue repair by Wellington firm Mesynthes.
Applied research	Undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective and determines possible uses of basic research.	Developing and testing a new pharmaceutical compound, as Argenta does for animal health products.
Basic research	Carried out to pursue a planned search for new knowledge with either a broad underpinning reference, or no reference to a likely application.	Investigating natural 'superhydrophobic' surfaces (highly repellent to liquids); may have application to condensation management, ice-prevention or as self-cleaning surfaces.

All industries engage in innovation. A lot of innovation does not require R&D. In the real world, R&D most often plays a problem solving role, rather than an exploratory role.

New Zealand's expenditure on R&D as a percentage of GDP is below the OECD average

Total expenditure on R&D as a % of GDP

% GDP, 2015

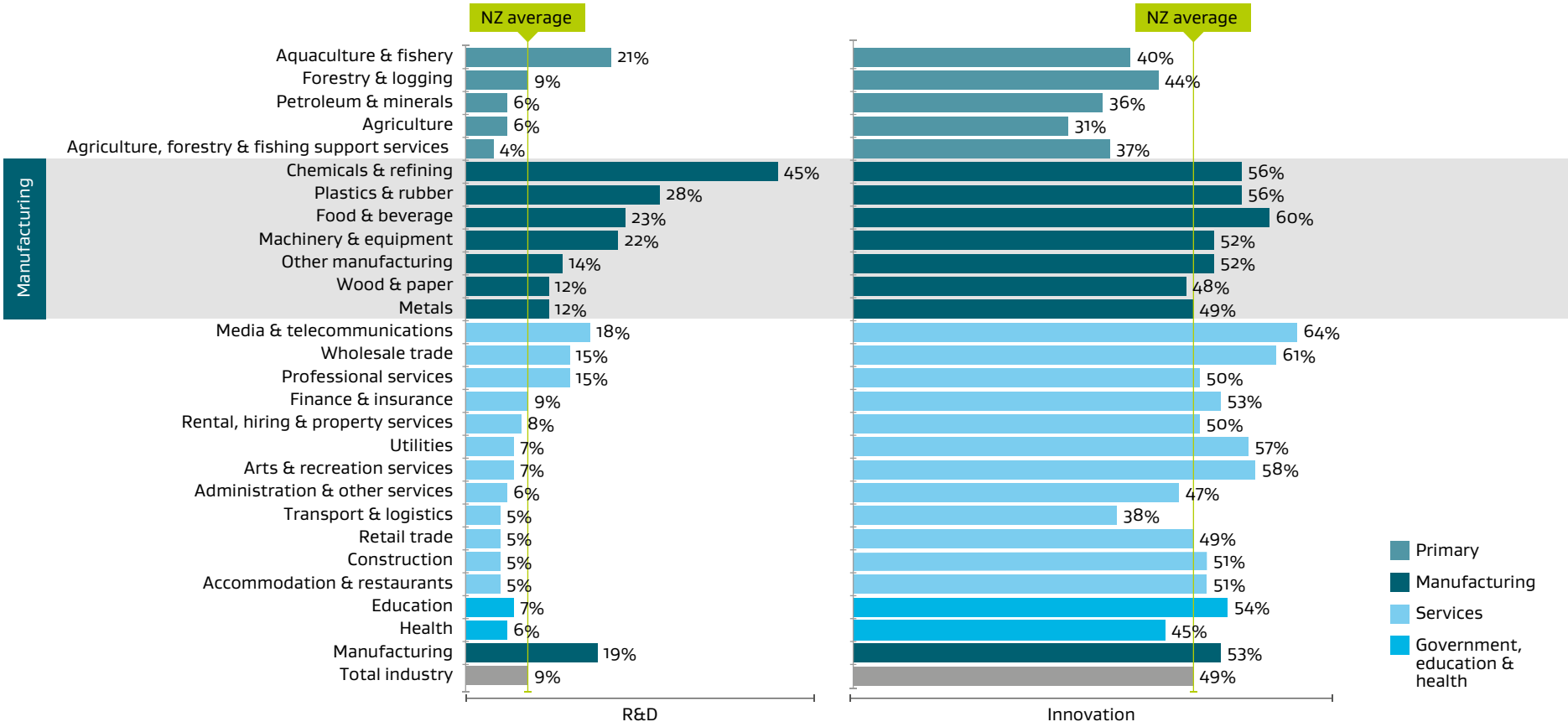


Source: OECD (2017), Gross domestic spending on R&D (indicator). doi: 10.1787/d8b068b4-en (Accessed on 01 December 2017).

R&D activity is more commonly reported amongst manufacturing firms than most other parts of the economy; innovation is common across all sectors

Firms reporting R&D activity; Firms reporting innovation activity

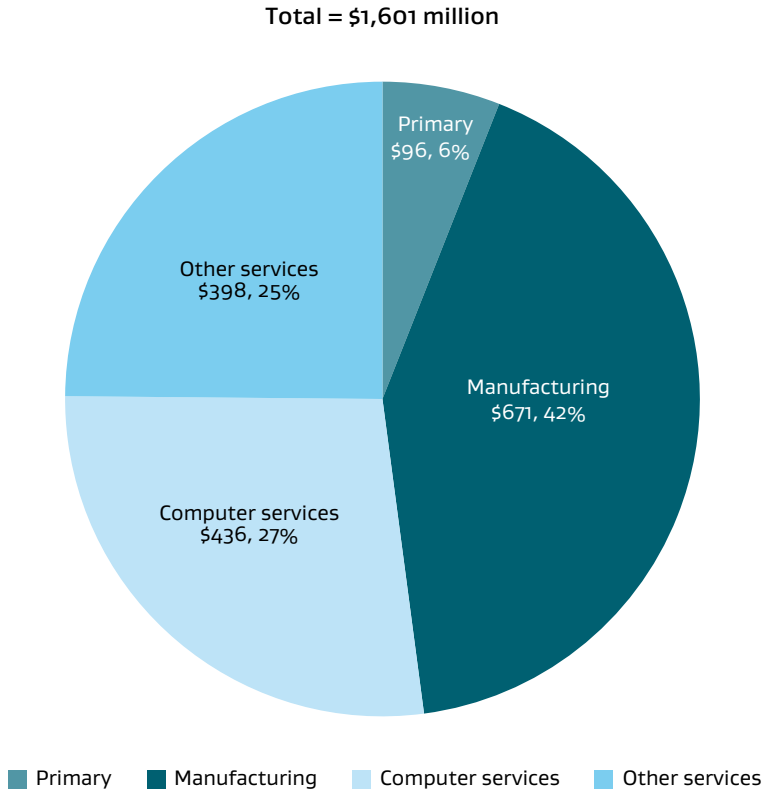
% of total firms in sector; 2015



Source: Business Operations Survey, Statistics New Zealand, MBIE analysis.

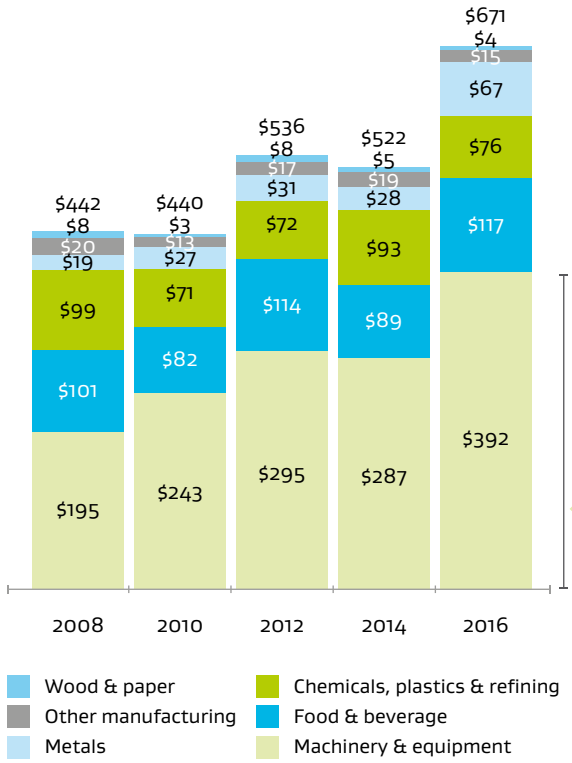
Manufacturing R&D expenditure is growing, driven by the 'machinery and equipment' subsector; manufacturing accounted for 42% of BERD in 2016

Business expenditure on R&D by major sector
NZ$ millions; % BERD, 2016



Source: National accounts, Statistics New Zealand.

R&D expenditure by manufacturing subsector
NZ$ millions, 2008–2016



	CAGR 2014–16	CAGR 2008–16	ABS 2008–16
	13.4%	5.4%	$229
	-10.6%	-8.3%	-4
	-11.1%	-3.5%	-5
	54.7%	17.1%	$48
	-9.6%	-3.3%	-23
	14.7%	1.9%	$16
	16.9%	9.1%	$197

58% of manufacturing BERD

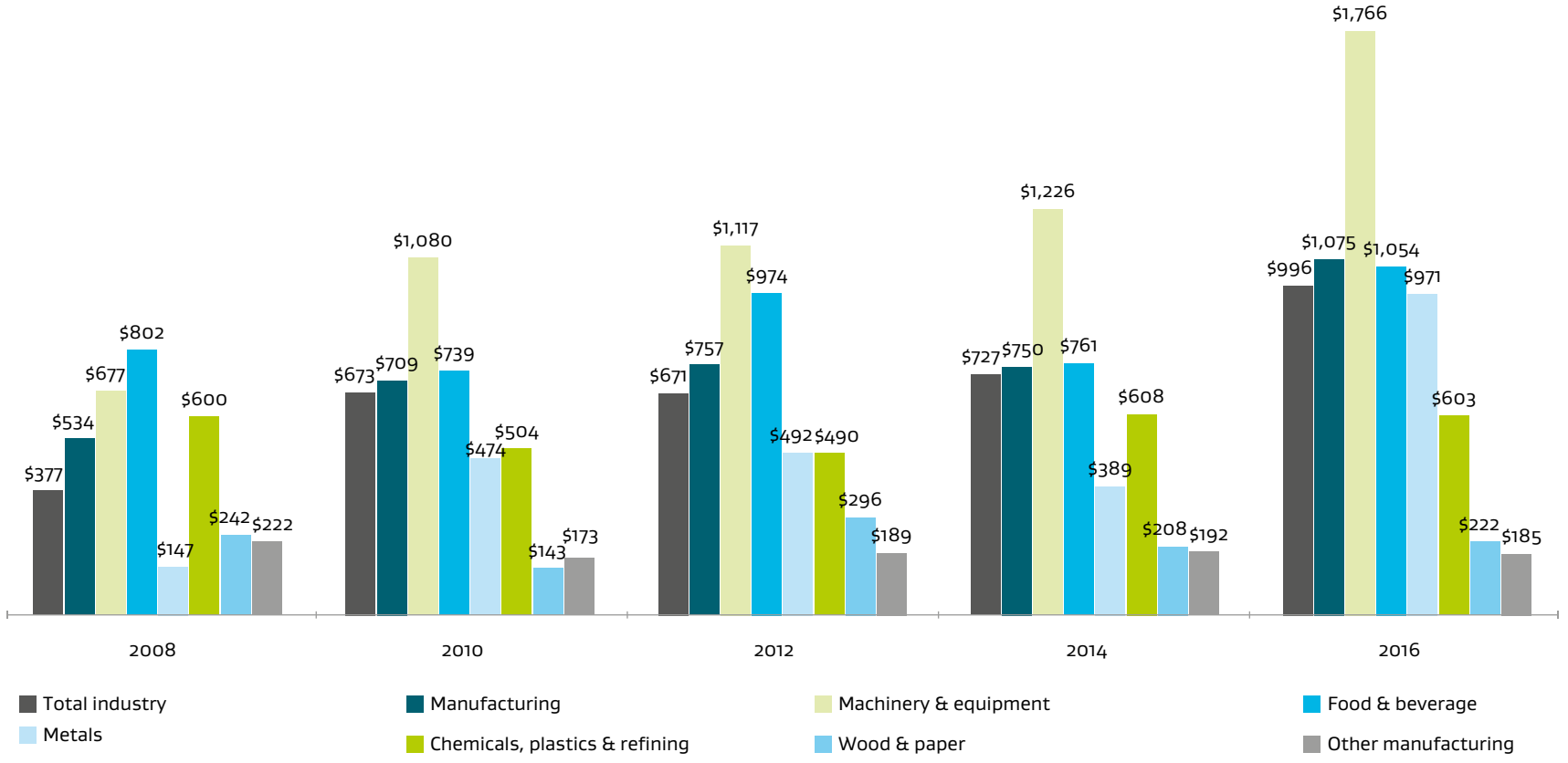
'Machinery and equipment' manufacturers typically produce high and medium-high technology products.

Note: Due to data limitations, 'chemicals and refining' and 'plastics and rubber' are shown as one subsector – 'Chemicals, plastics and refining'.

Source: R&D Survey, Statistics New Zealand.

‘Machinery and equipment’ manufacturers spend, on average, 70% more on R&D than the average New Zealand firm

Average R&D expenditure per firm that performs R&D
NZ$000, 2008–2016



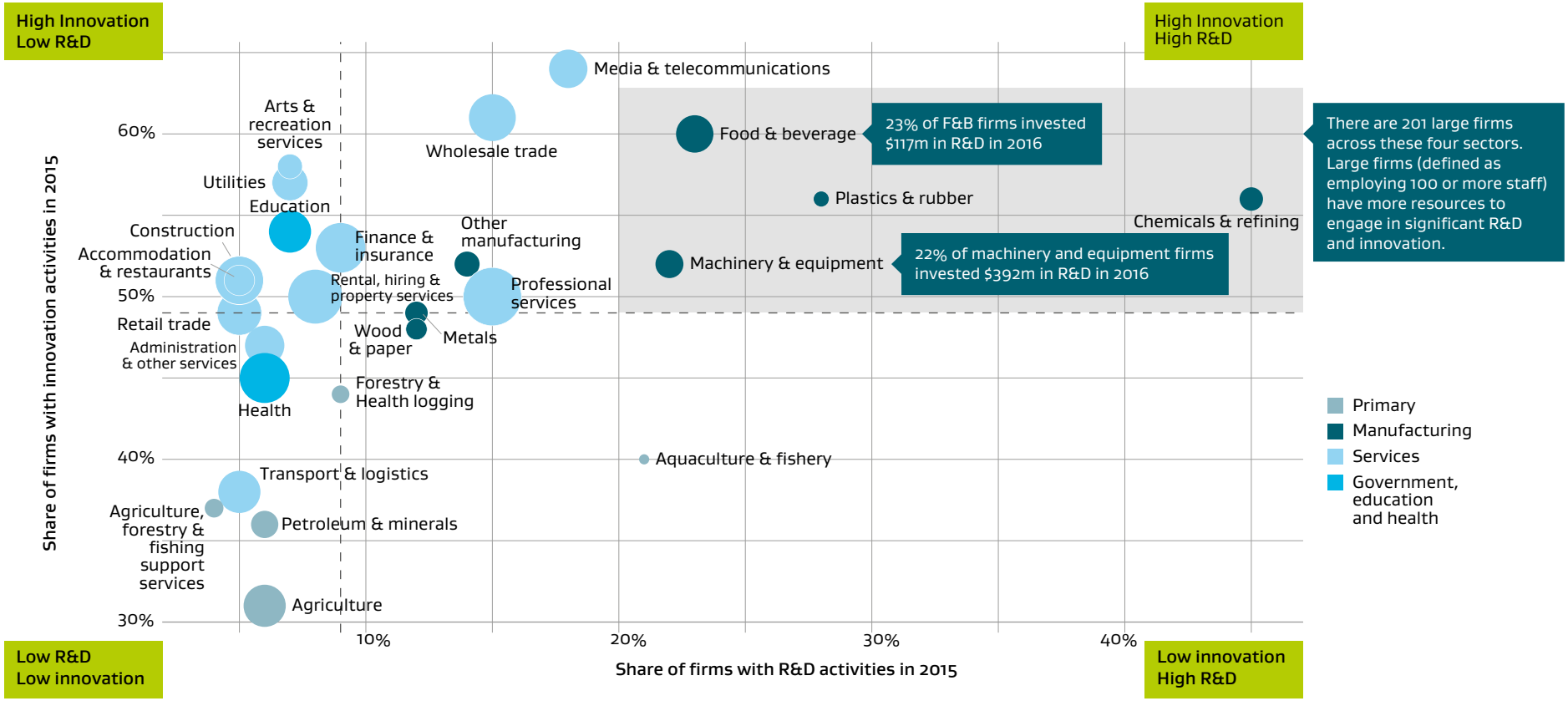
Note: These values are only for firms that perform R&D. Firms that don’t perform R&D are not included in average values.

Source: Business Operations Survey, Statistics New Zealand.

‘Food & beverage’, ‘machinery & equipment’, ‘chemicals & refining’ and ‘plastics & rubber’ manufacturing record high rates of both R&D and innovation

R&D rate (x axis) vs Innovation rate (y axis); size of bubble = real GDP share

% firms; % real GDP, 2015



Source: Business Operations Survey, Statistics New Zealand, MBIE analysis.

It is likely that a small number of firms account for the majority of recorded R&D expenditure, as these examples show

R&D expenditure, selected firms

Firm	Estimated expenditure on R&D
Douglas Pharmaceuticals	$20m+ (2016)[1]
Fisher & Paykel Healthcare	$86m (2017)[2]
Fisher & Paykel Appliances	$28m (2014)[3]
Fonterra	$80m+ (2016 est.)[4]
Scott Technology	$6.5–13m (2017 est.)[5]
Tait Communications	$25m (2017 est.)[6]
Total	$250m (Approx. est.)
% of total manufacturing R&D expenditure	37% (Approx. est.)

It is common internationally that a small number of firms at the technological frontier undertake the majority of a country's R&D

1 Source: Lee-Woolf, Y.H. (2016). Move over Viagra: Silvasta from Douglas Pharmaceuticals is chasing share of erectile dysfunction market. *Idealog*. Retrieved from http://idealog.co.nz/venture/2015/05/move-over-viagra-silvasta-douglas-pharmaceuticals-chasing-share-erectile-dysfunction-market

2 Source: Fisher & Paykel Healthcare. (2017). Annual Report 2017. Retrieved from https://www.fphcare.com/files/documents/investor-announcements/annual-interim-reports/2017/f-p034-annual-report-2017/

3 Source: Smylie, C. (2016). F&P Appliances local manufacturing dies as R&D steps up. *National Business Review*. Retrieved from https://www.nbr.co.nz/article/fp-appliances-plugs-more-rd-manufacturing-dies-cs-p-187162

4 Source: New Zealand Herald. (2016). Innovation playing a bigger role. *New Zealand Herald*. Retrieved from http://www2.nzherald.co.nz/the-country/news/article.cfm?c_id=16&objectid=11674528

5 Sources: Hopkins, C. (2017). Woodward Partners NZ Mid-Cap Spotlight [presentation]. Retrieved from https://www.scottautomation.com/assets/Announcements/2017-04-12-presentation+-+woodward+partners+nz+mid-cap+spotlight.pdf; Scott Technology Limited. (2017). Annual Report 2017. Retrieved from https://www.scottautomation.com/assets/Investor-Publications/Scott-Annual-Report-2017-WEB.pdf

6 Source: Tait Communications. (n.d.). Corporate overview. Retrieved November 20, 2017 from https://www.taitradio.com/__data/assets/pdf_file/0020/93125/Corporate-Overview.pdf; Technology Industry Network Ltd. (2017) *TIN Report New Zealand 2017* (13th Edition). New Zealand: Technology Industry Network Ltd.

Manufacturing industries can be categorised by the level of technology embodied in the product, which in turn requires more, or less, investment in R&D by the firm

The classification of manufacturing into high, medium-high, medium-low and low technology industries is based on the technological complexity (or embodied knowledge content) of the final product. Industries are categorised according to the average level of expenditure on R&D as a percentage of firm revenues. Individual firms may spend significantly more or less on R&D.

Classification of manufacturing by expenditure on R&D as percentage of revenues

Technology level	R&D as a % of revenues	ANZSIC classification examples	Example NZ firms
High 	>8%	› Aircraft and spacecraft › Pharmaceuticals › Computer and electronic office equipment manufacturing › Communication equipment manufacturing › Medical, precision and optical instructions	› Pacific Aerospace › Douglas Pharmaceuticals › 4RF › ADInstruments › Fisher and Paykel Healthcare
Medium-high 	Between 2 & 8%	› Electrical machinery and apparatus, not elsewhere classified (nec) › Motor vehicles, trailers and semi-trailers › Chemicals (excluding pharmaceuticals) › Railroad equipment and transport equipment, nec › Machinery and equipment, nec (e.g. appliances)	› ETEL › Action Manufacturing › Zelam; Ravensdown; Resene › Phil & Teds (“transport nec”) › Fusion Entertainment
Medium-low 	Between 1 & 2%	› Building and repairing of ships and boats › Rubber and plastics products › Petroleum refining and petroleum fuel manufacturing › Basic metals and fabricated metal products	› Oceania Marine › Talbot Plastics › New Zealand Refining › Steel & Tube
Low 	<1%	› Manufacturing, nec (e.g. furniture, jewellery) › Wood, pulp, paper, paper products, printing and publishing › Food products, beverages and tobacco › Textiles, textile products, leather and footwear	› Obo (hockey equipment) › Kinleith Pulp and Paper Mill › Fonterra; Villa Maria › Snowy Peak; Minnie Cooper

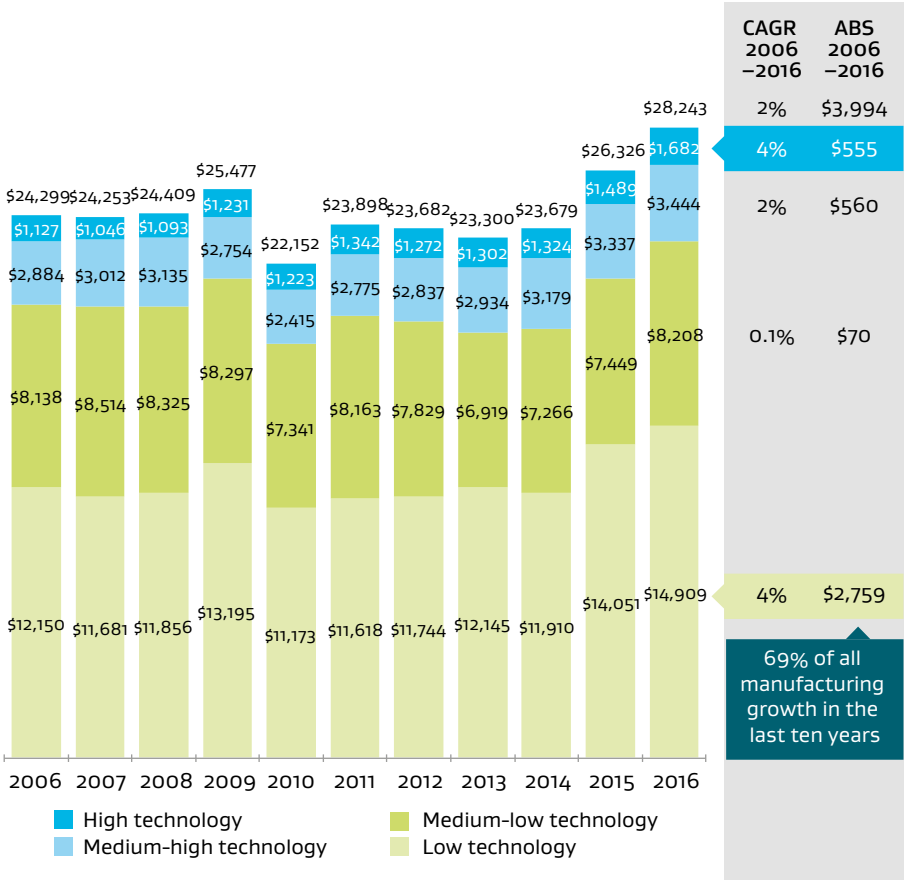
Higher technology or knowledge embodied in product, e.g. a silicon chip/software

Lower technology or knowledge embodied in product, but may utilise very high technology processes/ machines to produce. More likely to innovate through ‘learning by doing’ than formal R&D.

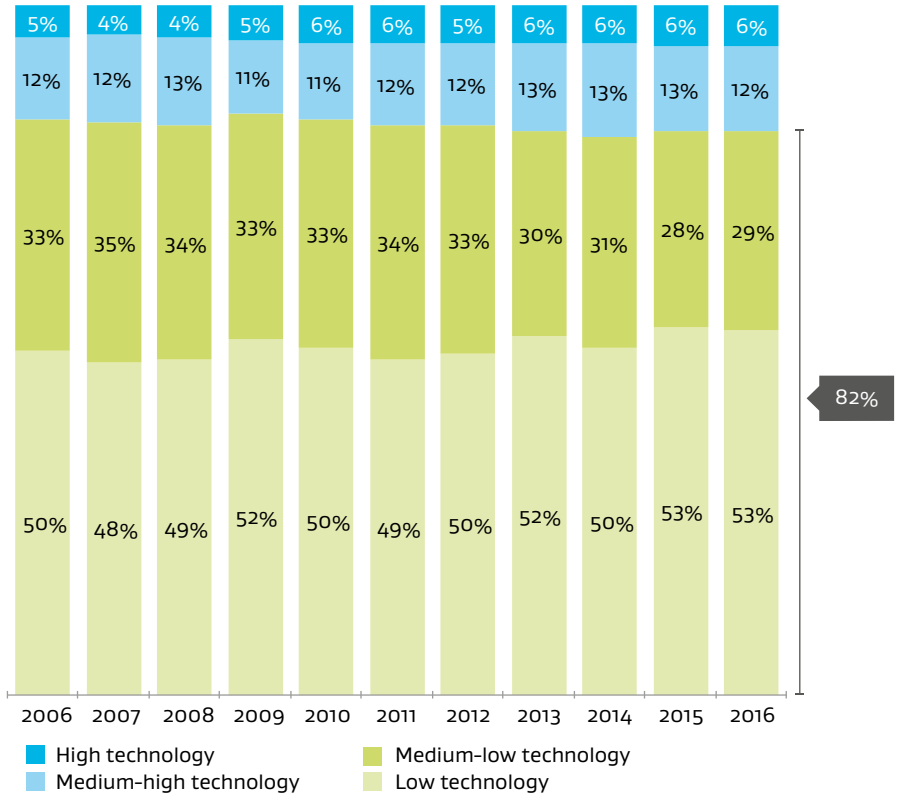
NZ production of high and low technology goods both grew at 4% in the ten years to 2016; in absolute terms low technology production added the most value

Low and medium-low technology manufacturing consistently contributes over 80% of New Zealand's manufacturing output (GDP)

Manufacturing output (GDP) by technology level
NZ$ millions, 2006–2016

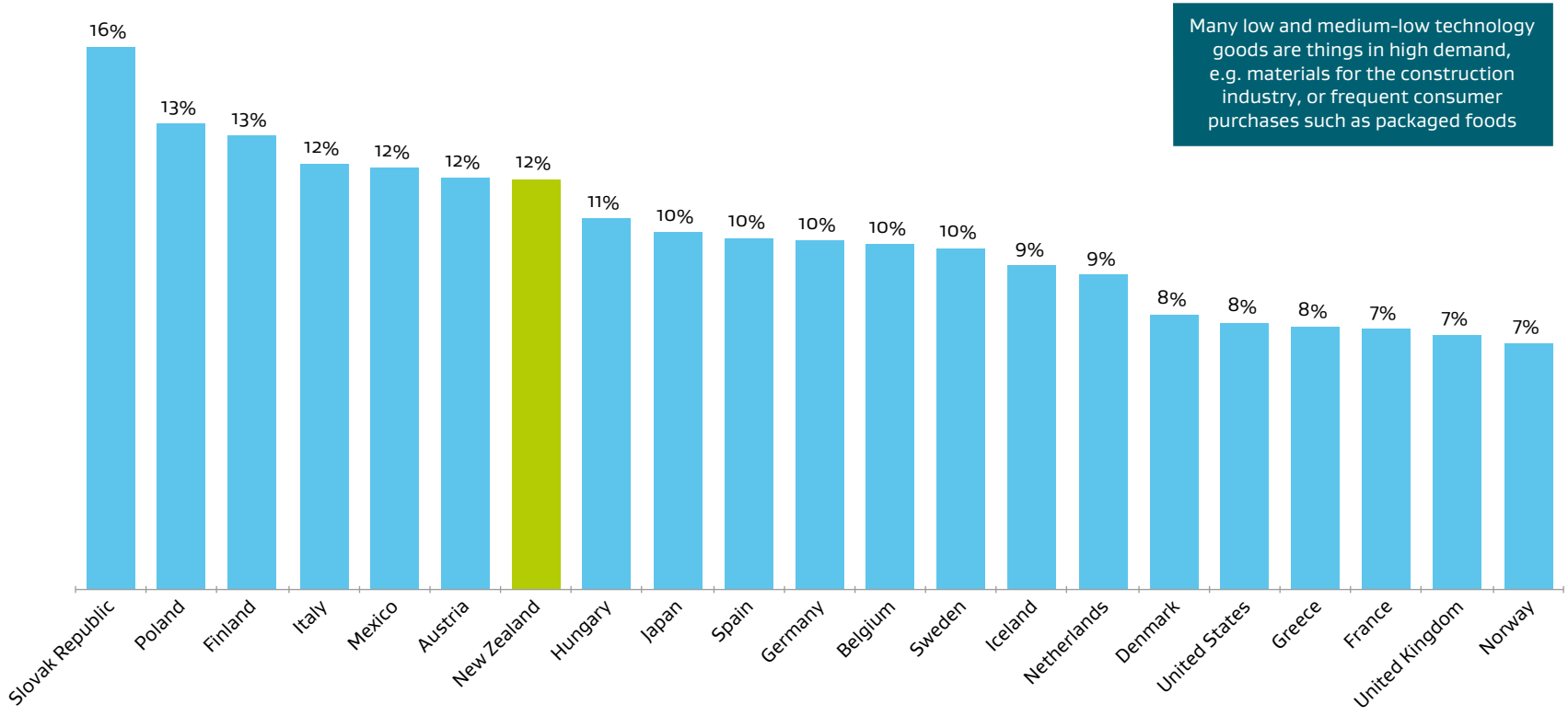


Share of manufacturing output (GDP) by technology level
% manufacturing GDP, 2006–2016



All developed economies have significant industries producing low and medium-low technology goods, such as food and beverage, steel, textiles, lumber and plastics

Low and medium-low technology manufacturing share of output (GDP); selected countries
% GDP, 2007



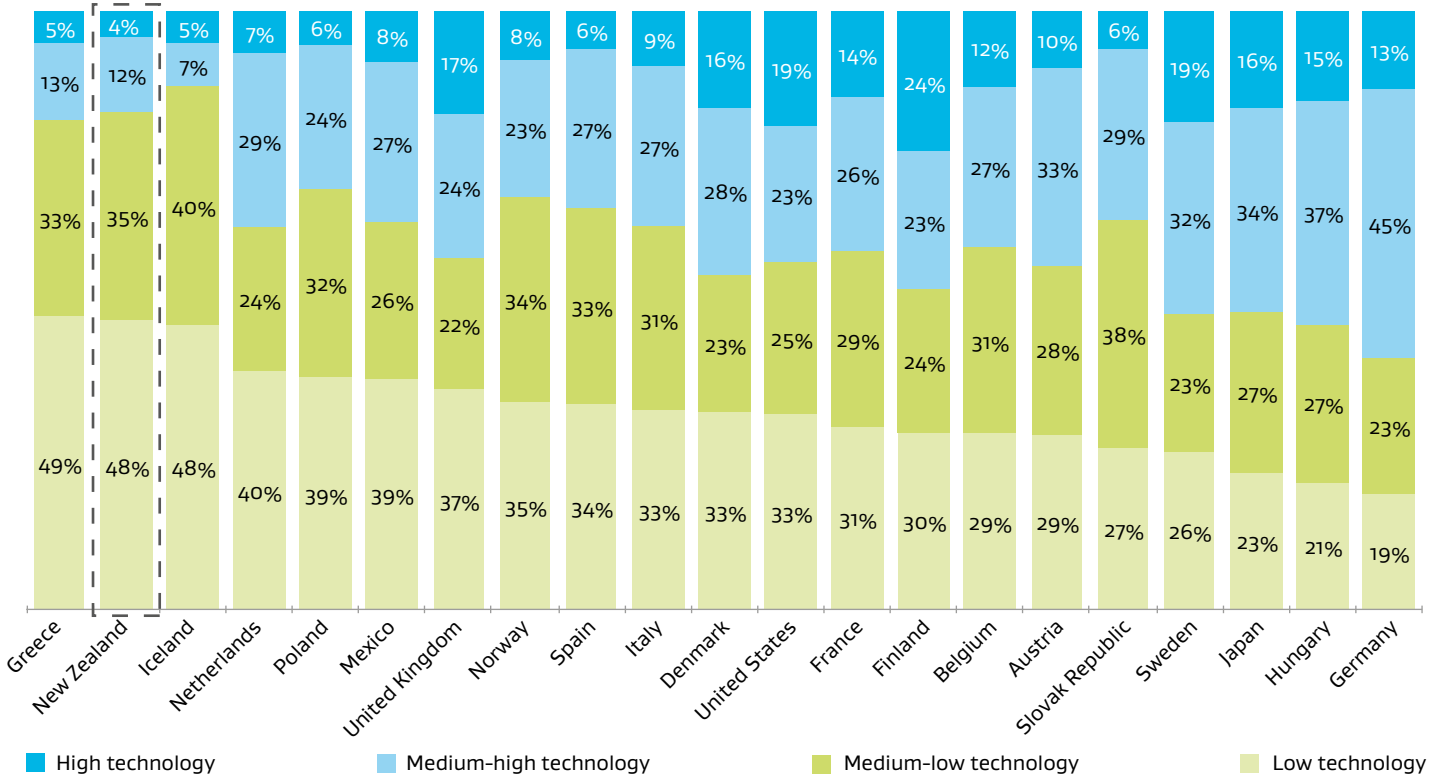
Note: 2007 figures were the latest data available.

Source: OECD STAN Indicators, Value added shares relative to total economy; Statistics NZ custom job.

Compared to most other developed economies, New Zealand manufacturing is more weighted to the production of low and medium-low technology goods

Share of manufacturing contributions to GDP by technology level

% manufacturing GDP, 2007



The key distinguishing feature in New Zealand manufacturing is the small size (12%) of the medium-high technology sector compared to peers (typically greater than 20%).

This might be explained by the fact that New Zealand does not have large-scale industries such as auto or appliance manufacturing.

Note: 2007 figures were the latest data available.

Source: OECD STAN Indicators, Value added shares relative to total economy; Statistics NZ custom job.

New Zealand's low technology industries, such as food and beverage, have high rates of innovation and significant development potential

Highly innovative

Globally, the food and beverage industry's expenditure on R&D is less than 1% of revenues, hence it is categorised as a low technology industry. It has, however, high rates of innovation. 60% of New Zealand's food and beverage firms engaged in some form of innovation in 2016, the highest rate of any manufacturing subsector.

High growth potential

There is increasing recognition that low technology industries in developed economies are not stagnant or declining – they are characterized by innovation and growth, and offer long term development potential.[1]

Such industries offer locational advantages that are difficult to compete away. For example, Marlborough sauvignon blanc can only be produced in Marlborough.

Secondly, these industries do not exist in isolation, but require significant inputs from a wide range of other industries which in themselves can provide important development opportunities and are often R&D intensive.

Collaborative and systemic

Innovation is not something that only happens inside a firm. It is more properly seen as the outcome of many interactions across a complex system.[2] Development of a new food product may entail an interactive process with supermarkets, equipment suppliers, packaging technologies, designers, the science system, raw material suppliers, technical experts, investors, market information, consumer testing and use of scale-up facilities such as those provided by the New Zealand Food Innovation Network.

R&D may be undertaken in different parts of this system by different players, rather than directly by the food manufacturer. Low technology innovation is therefore "characterised by a specific combination and continuous re-combination of high- and low-tech."[3]

1 Smith, K. Public Policy Framework for the New Zealand Innovation System, MED Occasional Paper, 2006.

2 ibid.

3 Hirsch-Kreinsen, H. (2015.) The Power of the Practical: low tech's neglected strength. University of Auckland Business Review, *18* (1). Retrieved from http://www.uabr.auckland.ac.nz/pdfs/thepowerofthepractical.pdf.

Firms typically focus on the commercialisation end of R&D

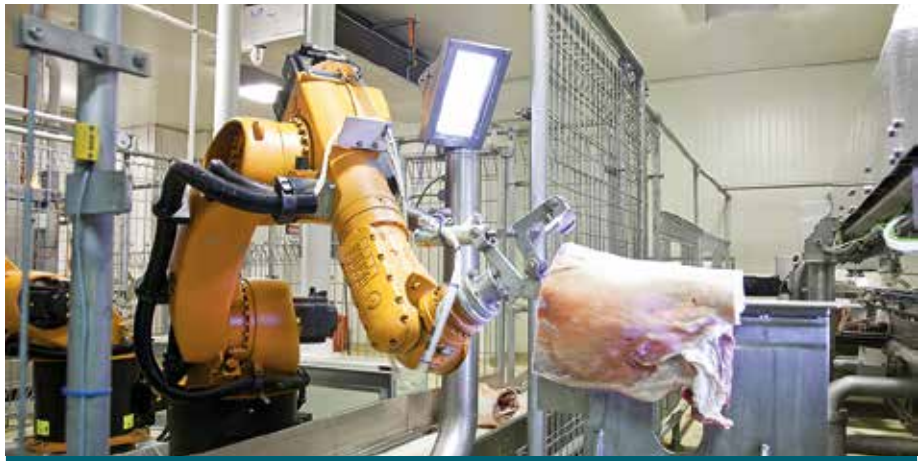
Over 90% of the cost of new product development in food and beverage is spent at the product commercialisation stage, that is the period after a prototype product has been prepared.[4] This is the stage where facilities such as those provided by the New Zealand Food Innovation Network can dramatically improve the chances of success (or quickly prove failure, which is equally valuable).

The technical hurdles (fundamental/applied sciences often done in universities and Crown Research Institutes (CRIs)) are relatively minor components of the commercialisation process.

R&D is only one measure of knowledge intensity. For example, product design and packaging are not considered R&D but are a fundamental part of the development of a successful consumer food product, as the 'yoghurt suckies' example shows.*

* Used with permission from Epicurean Dairy (The Collective).

Low technology producers may invest less than 1% of revenues in R&D themselves, but drive significant demand for high technology systems



Scott Technology invests in R&D to develop robotic meat processing equipment in a joint venture with Silver Fern Farms

SILVER FERN™ FARMS

Silver Fern Farms buys the system. Scott Technology is a major exporter.

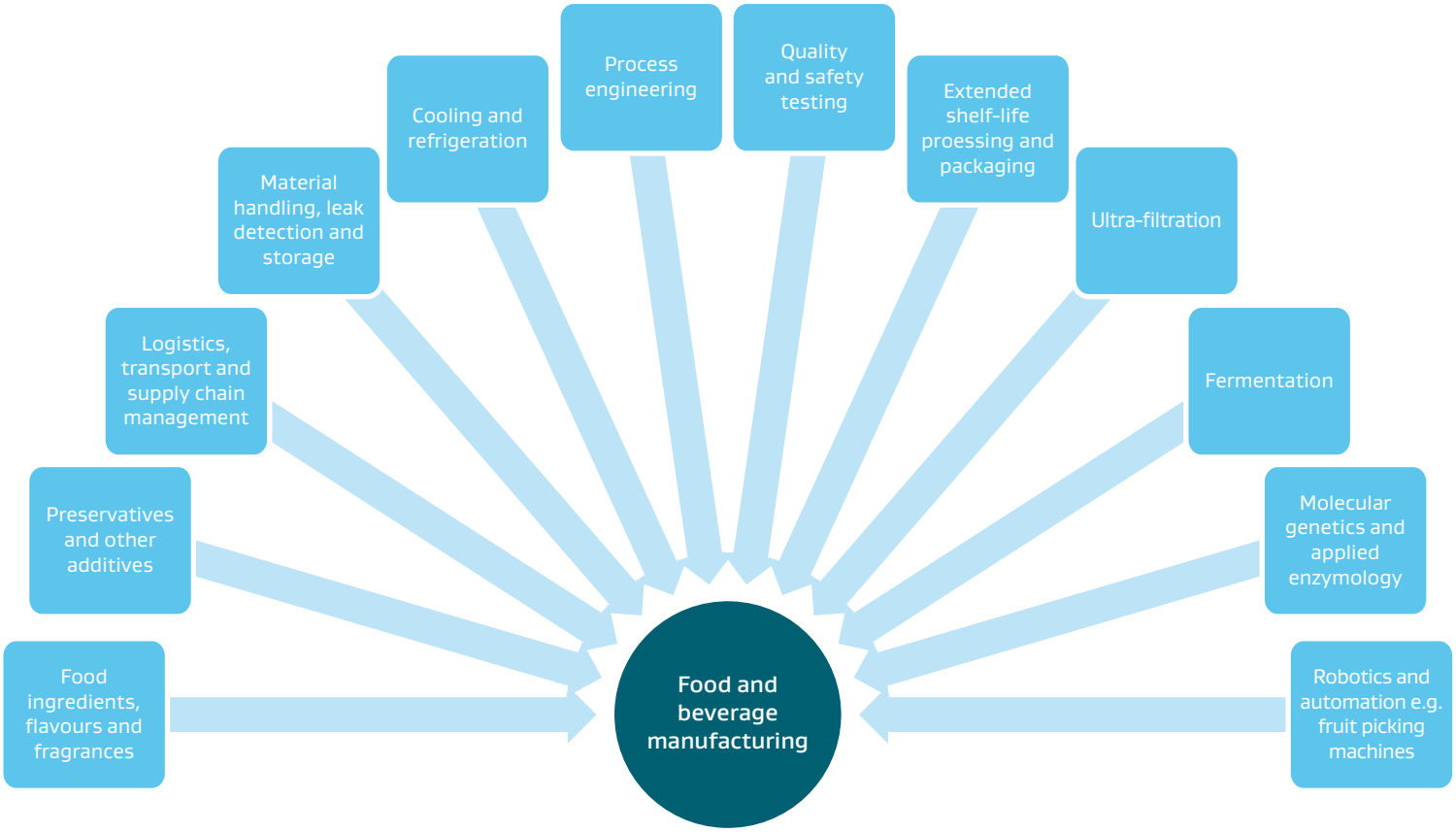
4 Winger, R. Food Product Development Value Chain, 2007 (unpublished paper); available on request from MBIE.

Other sources:

Robertson, P. L. & Smith, K. (2008). Distributed Knowledge Bases in Low and Medium Technology Industries. Retrieved from http://www.utas.edu.au/__data/assets/pdf_file/0019/111178/Distributed-Knowledge-Bases-in-Low-and-Medium.pdf

Hansen, T. & Winther, L. (2014). Competitive low-tech manufacturing and challenges for regional policy in the European context—lessons from the Danish experience. *Cambridge Journal of Regions, Economy and Society 7*, pp 449–470.

‘Food and beverage’ manufacturing is a major user of knowledge generated in other industries, helping drive innovation across the economy



Source: Rama, R. Handbook of Innovation in the Food and Drink Industry, New York, 2008.

Callaghan Innovation is the government agency supporting businesses to develop and commercialise technology, and preparing them for the future

Callaghan Innovation has helped 891 manufacturing firms grow their business using technology over the last year. The manufacturing sector is ready and willing to grow and advance through innovation and is the focus for much of Callaghan's engagement and services.

Callaghan Innovation aims to inspire and connect manufacturers to emerging and disruptive technologies.

Digital advances are changing the way the manufacturing ecosystem works – from design through to product build. Sensors now capture information about the manufacturing process to increase quality, reliability and productivity, to predict maintenance, to reduce downtime and save costs.

Digitisation of manufacturing is connecting sensors to machines, machines to workers (via new augmented reality interfaces), products and processes to the cloud and more. Additive manufacturing, or 3D printing, is now enabling production of highly complex parts for innovative design solutions, and individually tailored manufacturing outcomes. Callaghan Innovation works to connect businesses to emerging manufacturing technologies to help create a sector that is producing smartly, efficiently and safely.

Callaghan Innovation offers a range of services and programmes to the manufacturing sector.

- Callaghan Innovation can offer specialists in advanced engineering, robotics, automation and manufacturing technology, and help solve complex manufacturing and design challenges.
- Callaghan Innovation can provide system design and engineering of robotics as well as smart systems that react appropriately to new situations. It also offers a collaborative robot that manufacturing businesses can trial as appropriate.
- Callaghan Innovation's advanced additive manufacturing centre, the AddLab, offers polymer and metal 3D printing capability.
- Driving Innovation is a new 12-month skills development programme for growing manufacturing businesses to help them uncover new ways to innovate. It helps increase the pace of innovation with new product development methods.
- The Better by Lean programme helps businesses improve performance by focusing on activities that add value for customers while eliminating waste in inefficient processes. 721 people attended the Better by Lean manufacturing programme in the last year.

Callaghan Innovation offers a suite of R&D grants and is structured to meet a range of business needs. 196 manufacturing firms have received an R&D grant from Callaghan in the last year.

- Growth Grants support evolving, multi-year R&D programmes in businesses that are experienced R&D performers.
- Project Grants help businesses to develop specific products, processes or services with the aim of growing their commitment to R&D.
- Student Grants provide businesses with access to both undergraduate and postgraduate students who can assist in R&D projects and thereby gain commercial experience.

Industry 4.0 – the digitisation of manufacturing – will mean smarter, more efficient factories

The 'smart factories' of the future will be fully digitised. Intelligent software will be integrated with automated machinery to manage everything from inventory and customer orders, to manufacturing processes, to scheduling maintenance and ordering spare parts. This change is being referred to as the fourth industrial revolution, hence 'Industry 4.0'.[1] Industry 4.0 technologies can include:

The **Internet of Things**, where objects, machines, animals or people (think of your Fitbit) are connected to the internet. These objects can be connected to, and interact with, each other to collect and exchange data. In a factory, that might include sensors to identify process bottle-necks or when tools are becoming worn or require maintenance.

Machine learning occurs when complex algorithms enable computer systems to learn and make simple decisions by themselves. For example, computer systems in a factory can be wirelessly connected to automated machinery, so the system can automatically order new inventory or request a replacement part.

'Digital twins', or computer models, of a manufacturing product or process can be built using data collected by sensors. This enables real-time status updates and the trialling of 'what-if?' scenarios, without putting actual manufacturing plant or products at risk.

Robots and automation can be acquired as new plant or retrofitted to existing machinery to enable increased efficiency and precision, or to deliver health and safety benefits by performing repetitive and dangerous tasks.

Digital manufacturing converts digital design data directly into physical objects. '3D printing' is an example that can allow new geometries and internal structures for lighter, stronger and more cost-effective designs. Another example is customer orders being sent directly to an automated processing machine to manufacture the product.

Augmented and virtual realities are visualisation technologies that can assist product development, staff training and the identification of maintenance and performance issues.

Industry 4.0 will impact on jobs and on manufacturers' competitiveness

The adoption of Industry 4.0 is likely to lead to fewer, but more highly skilled manufacturing jobs over the longer term. These jobs will be safer, as robots can undertake more hazardous tasks. This has implications for employees, who may need training or upskilling, and for the skill sets that employers will need.

Industry 4.0 technologies have the potential to make the type of short run, customised production that New Zealand manufacturers specialise in more efficient and therefore more profitable. However, these technologies will also improve the flexibility and profitability of competitors, particularly large scale manufacturers that may be better able to fund the capital investments needed.

Uptake of Industry 4.0 requires firms to invest in capital and in the organisational know-how to use this effectively. Many of the firms profiled in this report are doing this already.

1 The other industrial revolutions were: first, the use of steam and the shift from human labour to mechanised manufacturing in the 19th century; secondly the advent of electricity and mass production; and third the development of computers and beginning of automation.

Sources:

Callaghan Innovation

Baur, C. & Wee D. (2015, June) Manufacturing's Next Act. Mckinsey & Co. Retrieved from https://www.mckinsey.com/business-functions/operations/our-insights/manufacturings-next-act

Hinks, Jamie (2015, April 8) 5 things you should know about Industry 4.0. Techradar.pro. Retrieved from http://www.techradar.com/news/world-of-tech/future-tech/5-things-you-should-know-about-industry-4-0-1289534

Marr, Bernard (2016, June 20) What Everyone Must Know about Industry 4.0. Forbes. Retrieved from https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#682a0748795f

R&D undertaken in universities and CRIs can lead to the creation of new, innovative manufacturing firms and products

The following are examples of key technological innovations leading to new manufacturing firms, or new products for existing manufacturing firms, that have emerged from research programmes and partnerships run by New Zealand universities or CRIs.

Firm name	Manufacturing subsector	Description
ClimbMAX International Limited	Machinery & equipment	The Primary Growth Partnership in Steepland Harvesting, managed by Forest Growers Research, developed expertise in machines for tree felling and harvesting on the steepest slopes. ClimbMAX now produces harvesters that can work on 45 degree slopes productively and safely and has made sales in New Zealand, Canada and the US. The underlying technology was further developed by other firms to create more innovative machines. In total around 125 machines based on the underlying technology have been sold in New Zealand and overseas.[1]
Ligar Polymers	Chemicals & refining	Growing out of research at the University of Waikato and Wintec, Ligar uses molecularly imprinted polymers for filtering and recovering very specific molecules at a large scale. Ligar can target organic chemicals or metals, extracting the molecules from the environment and potentially allowing reuse of the molecule. For example, Ligar polymers can be used to remove smoke taint from wine.
StretchSense	Plastics & rubber	Based on research into flexible conductive polymers at the University of Auckland, StretchSense produces soft sensors for wearable electronics, tailored for sports and fitness applications. Since 2012 they have received substantial international investment and now employ over 100 staff.
Ossis	Metals	Provides better outcomes for patients needing hip replacements. Ossis produces 3d printed titanium bone implants and grew from research into 3D printing of titanium carried out by a collaboration of the University of Waikato, Callaghan Innovation, GNS Science, and the University of Auckland.
Energia Potior Limited	Machinery & equipment	Research from the Light Metals Research Centre at the University of Auckland was developed into EnPot technology, a series of heat exchangers that allows aluminium smelters greater control over the temperature used in their smelters. This means the energy used can be adjusted to match electricity price fluctuations and allow more usage of electricity from renewable sources. EnPot state this is "one of the most important breakthroughs in aluminium smelting in 125 years".
New Zealand King Salmon	Food & beverage	Research with the Bioresource Processing Alliance enabled New Zealand King Salmon (an independent, pre-existing company) to launch a new line of pet food salmon dry kibble. These are made from salmon off-cuts that would previously go to waste but now hundreds of tonnes are being sold for this high-value use and the company is considering expanding sales into the US.

1 Source: Forest Growers Research Ltd.

Industry commented on their investment in innovation and automation

"Innovation is critical from our customers' point of view and it never stops. You look at innovation and combine it with technology, the ante just keeps going up and up and up all the time."

Anonymous

"If you don't innovate in an industry you die. So while the innovations [in the 'metals' sector are] not widely known, I think you will find in all these businesses there is continual innovation you must do in order to stay relevant."

Executive director, 'metals' firm

"A new product is one thing, an evolution of an existing product is also – in our world – development."

Board member, 'machinery and equipment' firm

"We are better to use innovation as our protecting mechanism as opposed to a patent."

Board member, 'machinery and equipment' firm

"We've invested a lot of money. . . in state of the art machinery to further enhance our productivity because that's the only way we are going to stay ahead of local and imported competition."

General manager, 'metals' firm

"In many places you will not be able to justify the investment in a piece of automation equipment purely by the volumes that are being run. They are too low."

Board member, 'machinery and equipment' firm

"At the end of the day, if anything automation has actually allowed us to service the market better with the same number of people but we are putting out more product than we ever did."

General manager, 'metals' firm

"We can now dial into a machine, we can reset faults, we can communicate whilst we are troubleshooting with the customer. I want you to do this, I want you to do that. And the truth is we can get revenue out of it."

Executive director, 'machinery and equipment' firm

Case Study: Agritech is an area of competitive advantage for New Zealand

New Zealand has a long agricultural history based primarily on pastoral farming. This agricultural heritage, combined with a favourable climate and soils, has led to New Zealand being the #1 global dairy supplier, and #2 sheep meat supplier.

Supporting New Zealand's agricultural industry is a significant domestic agritech industry. Agritech consists of on-farm products and equipment that add value to agribusiness. These include:

- Breeding and animal genetics
- Seeds and plant genetics
- Animal feed and nutrition
- Animal health products
- Fertiliser
- Agri-chemicals
- Fencing supplies and equipment
- Farm tools and other hardware
- Pumping, water and irrigation
- Machinery and systems, and parts
- Farm vehicles, cultivators

Agritech is a cross-cutting sector. Though primarily agricultural, it can cross into other sectors. For example, NDA fabricate stainless steel for the dairy industry, as well as for the oil and gas industries. Gallagher produce containment/security systems for farm stock as well as for safari animals and prisons.

Agritech in New Zealand is a system wide success story. New Zealand has strong capabilities across the entire agribusiness supply chain: manufacturers of machinery and devices; scientists; educators; farmers; processors; retailers; and agricultural services.

To maintain a comparative advantage the agriculture industry is constantly looking to improve efficiencies and productivity while decreasing costs. Many manufacturing firms have evolved to provide on-farm products and services to support farmers and contribute to on-farm improvements. These firms' products range from fertiliser to fencing solutions, from pasture monitoring sensing equipment to complete automatic milking solutions.

New Zealand's agritech industry offers a rare opportunity for technological development at scale within a relatively small economy. The size of New Zealand's agriculture industry allows for profitable returns on R&D investments that may not be possible in other domestic markets. This encourages competition amongst agritech companies and investment in innovation.

The highly competitive approach to solving on-farm business problems is driving continued major investments in R&D amongst agritech firms. These solutions are also exported to the world. For example, New Zealand specialist seed companies AgriSeed and Carr Group grow and export seeds globally. Gallagher and Tru-Test export a broad range of fencing and monitoring systems. Simcro specialise in drench guns and injectors working closely with animal health companies and Waikato Milking Systems export milking systems, to name a few.

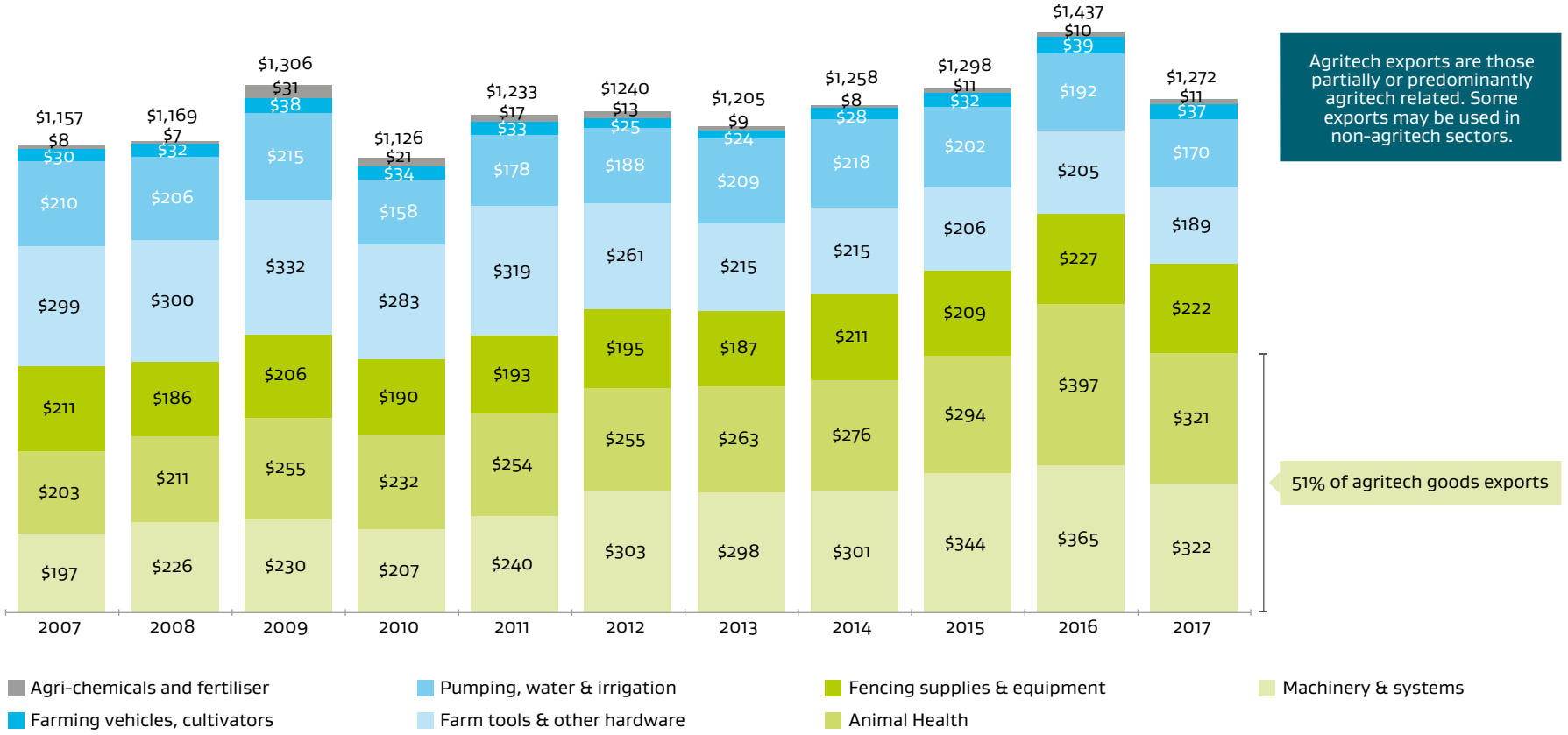
Because of agritech's cross-cutting nature, the benefits of investments in R&D often have impacts across a wide range of sectors, sparking innovation and growth in areas outside of agriculture.

Adapted from research on New Zealand's agritech sector by Coriolis Research. Used with permission.

New Zealand exported over $1.2 billion in agritech goods in 2017; over half of these exports were machinery and systems and animal health products

Agritech exports

NZ$ millions, year end June 2007–2017



Source: Exports data, Statistics New Zealand.

New Zealand's strong primary sector has enabled the development of many successful agritech manufacturers

Firm name	Manufacturing subsector	Description
NDA Group	Machinery & equipment	Hamilton based specialty manufacturer of industrial storage and process vessels, including dairy and wine equipment. Formed in 1997, the company is privately owned and employs 550 staff. NDA Group's revenue in 2016 was $150,000,000.
TruTest	Machinery & equipment	Auckland based manufacturer of a variety of agritech machinery, including weighing solutions, milk meters and milk cooling, electric fencing and dairy automation solutions. Formed in 1964.
Ravensdown	Chemicals & refining	Agritech company focused on producing (primarily superphosphate) fertilisers for New Zealand farms, as well as agri chemicals, animal health products, seeds and more. Ravensdown was set up in 1977 and operates as a farmer cooperative with approximately 25,000 farmer shareholders.
Compac Sorting Equipment	Machinery & equipment	Auckland based producer of sorting and automation solutions for the produce industry. Formed in 1984, the company is privately owned and employs around 650 staff. Compac Sorting Equipment's revenue in 2016 was $145,000,000.
Argenta	Chemicals & refining	Auckland based manufacturer of animal pharmaceutical products. Formed in 1956, Argenta has developed products including tablets, oral liquids, gels and injectables to improve the health of animals all around the world, with accreditations in the US, Canada, EU, Australia and New Zealand.
Gallagher Group	Machinery & equipment	Manufactures a wide range of farming equipment, especially electric fencing and gates, electronic weighing and identification and petrol pumps. Formed in 1938.
Waikato Milking Systems	Machinery & equipment	Iwi owned New Zealand company that produces automatic and manual milking systems and associated dairy equipment, including rotary platforms. Formed in 2001.
Southfence Machinery	Machinery & equipment	World leader in fence manufacturing technology. Southfence manufactures the machinery used to create wire fencing and exports around the world. Southfence machinery spun off from New Zealand Fence & Gate Works in 1986 and now operates out of Christchurch.

Case Study: Production Machinery Limited

Production Machinery Ltd (PML) is a supplier of "smart factory" solutions, primarily to the appliance manufacturing industry.

Since the company's launch in 1985, PML's focus has been on producing highly automated, special-purpose production line machinery for a range of industries.

The business had its genesis in Fisher & Paykel's need for flexible manufacturing methods that would enable a single production line to build the entire range of any of its product categories. Fisher & Paykel developed the technology and built the machinery itself during the 1970s. In the early 1980s, PML was established to market this technology to other businesses, and now designs and builds machinery for manufacturers around the world.

PML offers a full range of factory solutions. This includes plant layout, factory simulation, design-for-manufacture consulting, service, plant and production monitoring and management software, as well as production equipment.

PML has a strong alignment with Industry 4.0 – the digital transformation of manufacturing technologies.

PML is constantly looking to integrate digital technologies into the company's production equipment. PML's strategy is to continually drive towards true smart factories – where it offers value to the customer.

The company has worked closely with Callaghan Innovation, which has introduced PML to New Zealand manufacturers that the company can assist in the digital transformation of their businesses.

John West, PML's Industry 4.0 Technology Manager says, "The next stage of our evolution is factory design. Instead of producing discrete equipment, we will work with manufacturing partners to produce total factory solutions. Our parent company Haier has a philosophy of going from mass production to mass customisation; enabling every product to be made as a batch of one."

The first of these new-direction products is PML's manufacturing operations management software product called COSMOline. The software unlocks the full potential of production equipment by collecting, analysing and acting on efficiency, quality, maintenance and environmental data generated by the equipment.

PML products are installed in manufacturing facilities in New Zealand, China, the United States, Mexico, Italy and Thailand (both internally within the Haier Group and for external customers), and they are looking to expand into other countries.

FISHER & PAYKEL
PRODUCTION MACHINERY LIMITED

Case Study: Niagara Sawmill

Niagara's modern sawmill supplies national and international markets with a range of kiln dried or treated timber used in the furniture and building industries. They have developed a wide selection of finishing products using solid or finger jointed timber.

Niagara sawmill creates a range of timber products for both domestic and international markets.

Niagara's export markets include South East Asia, Australia and North America. Roughly 45% of the company's exported product is rough sawn commodity product, of which 85% is industrial low-grade timber. A large proportion of that industrial timber is used in offshore furniture manufacturing.

Niagara has high investment in R&D, with a focus on increasingly automated manufacturing processes.

In July 2017, Niagara was in the process of spending around $16 million on upgrades to plant and buildings. The company sees this as a necessary investment to remain competitive by moving away from high labour costs and towards greater use of technology. New plant will include more high-tech laser scanning and x-ray technology to allow for automated timber and product handling.

Niagara's R&D investment is directed towards plant and machinery rather than new products. The company considers it makes more sense to focus innovation on creating more efficient and productive processes before trying to create new products. Because New Zealand's domestic market is small, any new product would need to have export potential, which requires greater risk and an understanding of different international markets.

Niagara sees increasing automation as a way of addressing skills shortages.

The company notes that the current tight labour market has made it difficult to recruit staff. Niagara requires some semi-skilled machine operators however they will train unskilled staff on the job.

Niagara is addressing this skills shortage through their R&D and process innovation programme. More efficient plant will allow them to produce greater volumes of product with fewer people.

Niagara is focused on possible solutions to mitigate challenges with the supply of logs in New Zealand.

Much of New Zealand's log supply goes straight to export and can be difficult for New Zealand manufacturers to obtain. Some forest owners are harvesting trees earlier for international buyers who are willing to pay for younger wood. Niagara notes that log supply is one of their biggest challenges.

The company is beginning to acquire its own forests in order to mitigate supply risk in the future.

NIAGARA
STRENGTH IN TIMBER

Case Study: AlphaGen

AlphaGen was founded in 2012 to explore the synergy between food, nature and science. The company has developed an all-natural drink that reduces brain fog, tension and fatigue, called Ārepa. AlphaGen spent four years researching and developing Ārepa. The drink is made with a formula of unique ingredients that target alpha brain waves to increase mental clarity.

AlphaGen has invested heavily in R&D to develop Ārepa. This included prototyping and clinically researching the drink through The FoodBowl and The Centre for Brain Research at the University of Auckland.

AlphaGen sees itself as a technology startup that produces natural and scientifically proven products. The company spent four years developing its Ārepa drink before the product was launched a year ago. They estimate that they have invested roughly ten times what the company made in their first year into R&D.

The formula for Ārepa was developed with neuroscientist Professor Andrew Scholey, and uses all natural extracts from New Zealand pine bark, blackcurrants and Japanese green tea. The drink aims to increase focus and mental acuity, reduce stress and be health promoting.

The company has carried out clinical trials to investigate the effects of drinking Ārepa on mood, and more clinical trials are planned to study the effects of Ārepa on brainwave activity. AlphaGen is constantly developing its Ārepa drink, with the goal of creating a replacement for energy drinks that is also good for your brain. The company plans to expand into other product types soon.

Ārepa is currently being sold in New Zealand and the UK, and AlphaGen plans to expand into more global markets.

Ārepa is currently available in high-end food stores in New Zealand, with a strategy to increase availability as the company grows. Ārepa is also available in the UK through its online store. Company founder Angus Brown comments that online retail has been a game changer in terms of the company's ability to export without relying on retailers.

The company is aware that its plans to expand globally will mean increased competition. They are seeking to protect their product through a pending global patent. Investment from key ingredient suppliers means that the company is scaleable and will be able to service international markets such as China as the company expands.

In addition to high R&D activity, AlphaGen has been innovative in its marketing and branding activities.

The company has identified a number of niche markets for Ārepa sales, with its main target customers being students and stressed professionals. Ārepa taps in to the rapidly growing Lifestyles of Health and Sustainability (LOHAS) market and the global nootropics market (products made with ingredients that improve cognitive function).

Ārepa positions itself as a premium product. The company's R&D not only feeds product development but also translates into marketing opportunities. AlphaGen considers that its focus on scientific research future-proofs the company's products and makes it more attractive for investment from large multinationals.

ĀREPA

SECTION 7

International trade

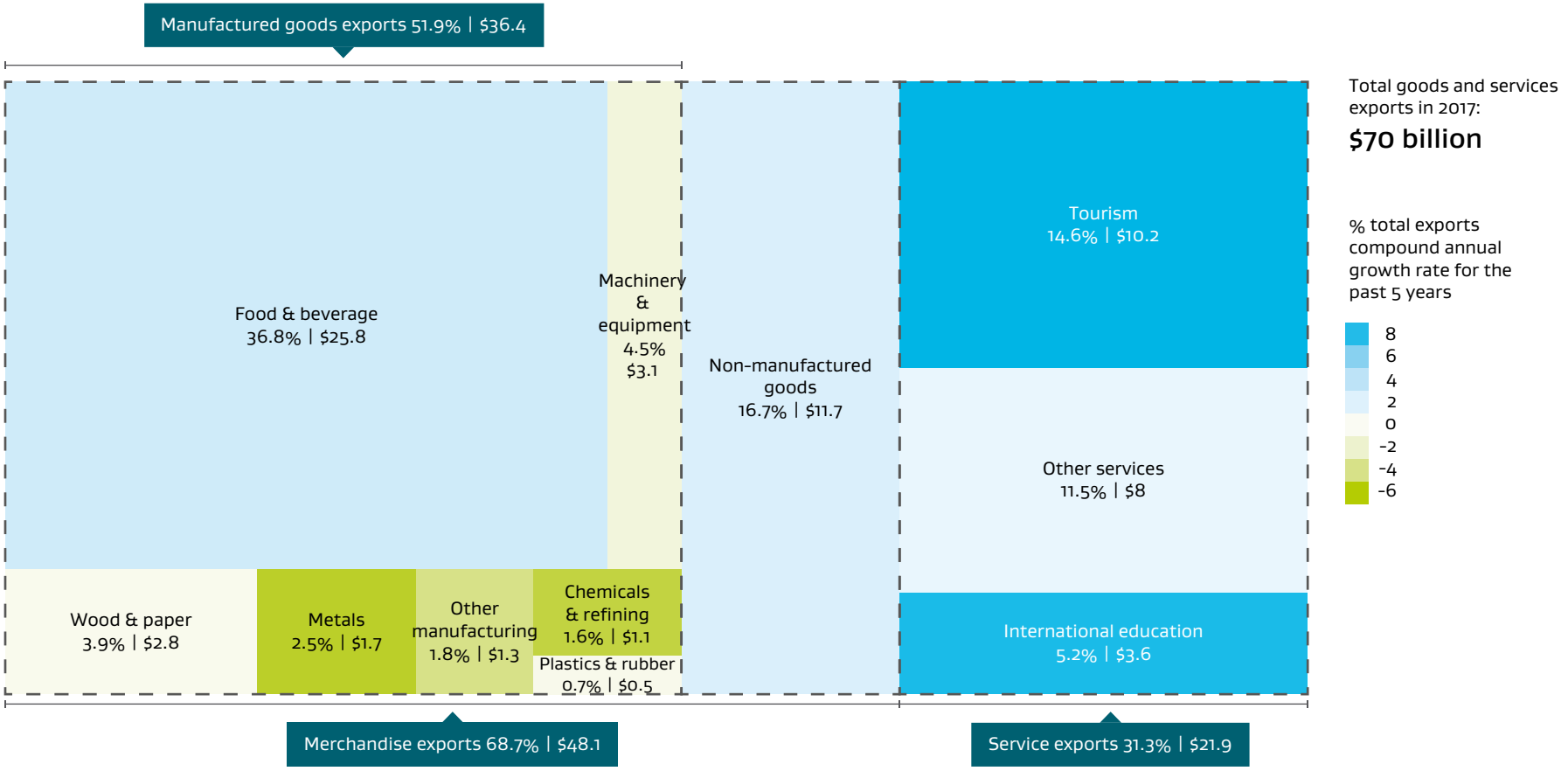
International trade: Key points

- Manufactured goods make up over half of all New Zealand's exports (goods and services).
- 'Food and beverage' manufactured goods make up 71% of total manufactured goods exports.
- Manufactured goods exports have grown at 3% CAGR in the ten years to 2017, driven largely by growth in the export of 'food and beverage' products.
- New Zealand consistently imports more manufactured goods than it exports.
- Manufacturing firms have higher rates of investment by foreign firms, and are more likely to have overseas investments themselves, than the New Zealand average.
- New Zealand manufacturing firms may choose to locate some or all of their manufacturing offshore for a number of reasons, including in order to be price competitive, close to market or to access capabilities not available in New Zealand.

Manufactured goods make up over half of New Zealand's total exports

Exported goods and services by subsector

% exports; NZ$ billions, year end June 2017

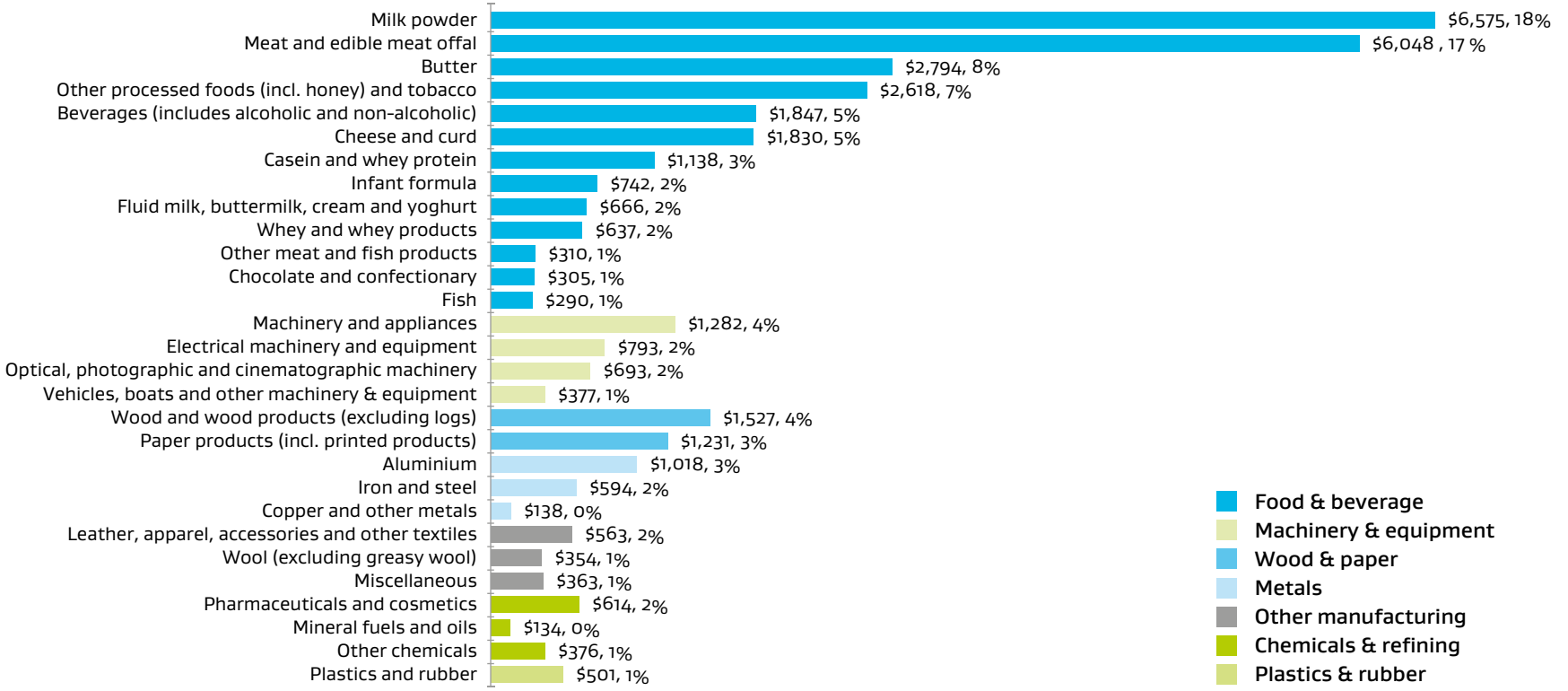


Source: Exports data, Statistics New Zealand

New Zealand exports a highly diverse range of manufactured goods

Manufactured exports by category

NZ$ millions; % total manufactured exports, year end June 2017

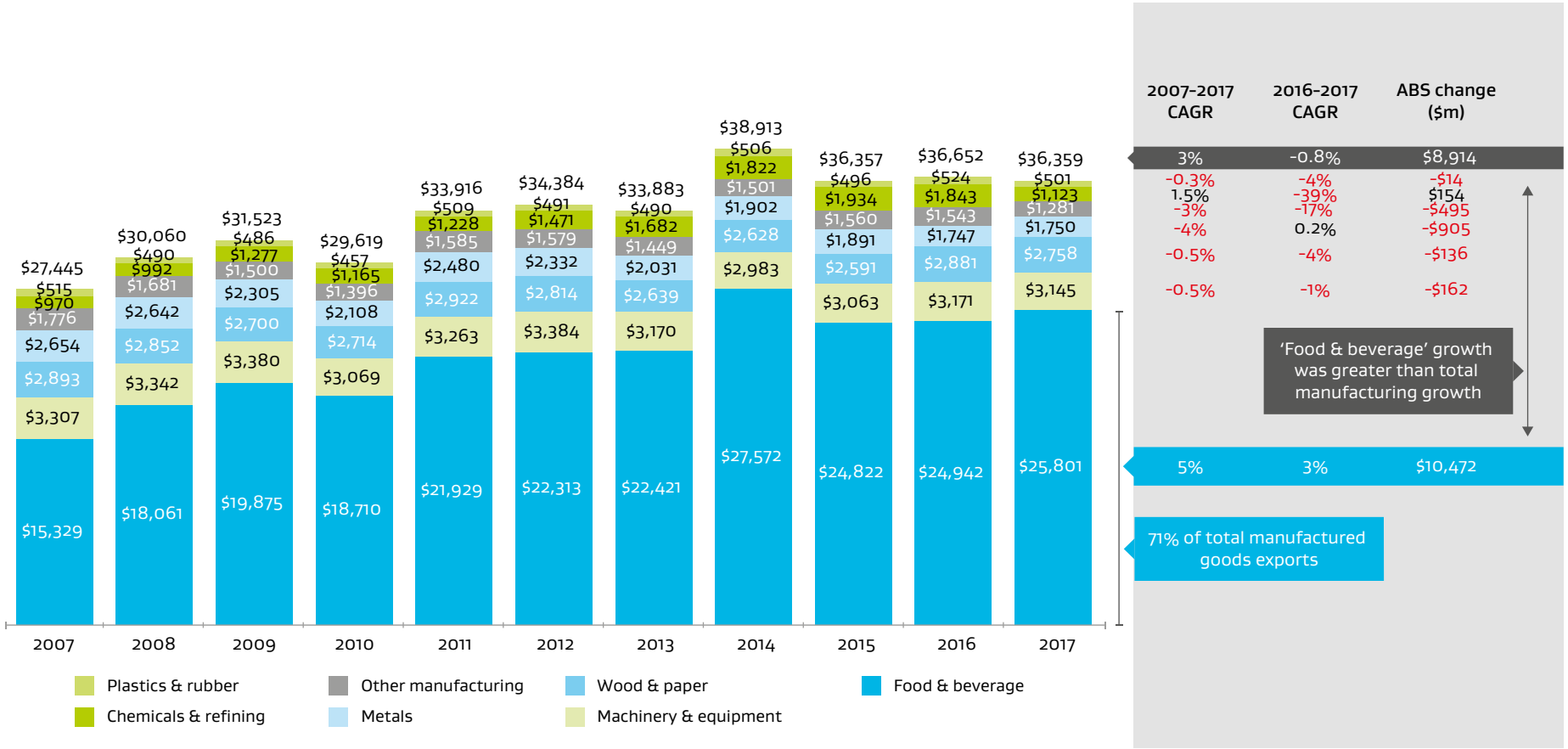


Source: Exports data, Statistics New Zealand

‘Food and beverage’ products make up 71% of all manufactured goods exports and have shown consistent growth over the last decade

Manufactured exports by category

NZ$ millions, year end June, 2007-2017

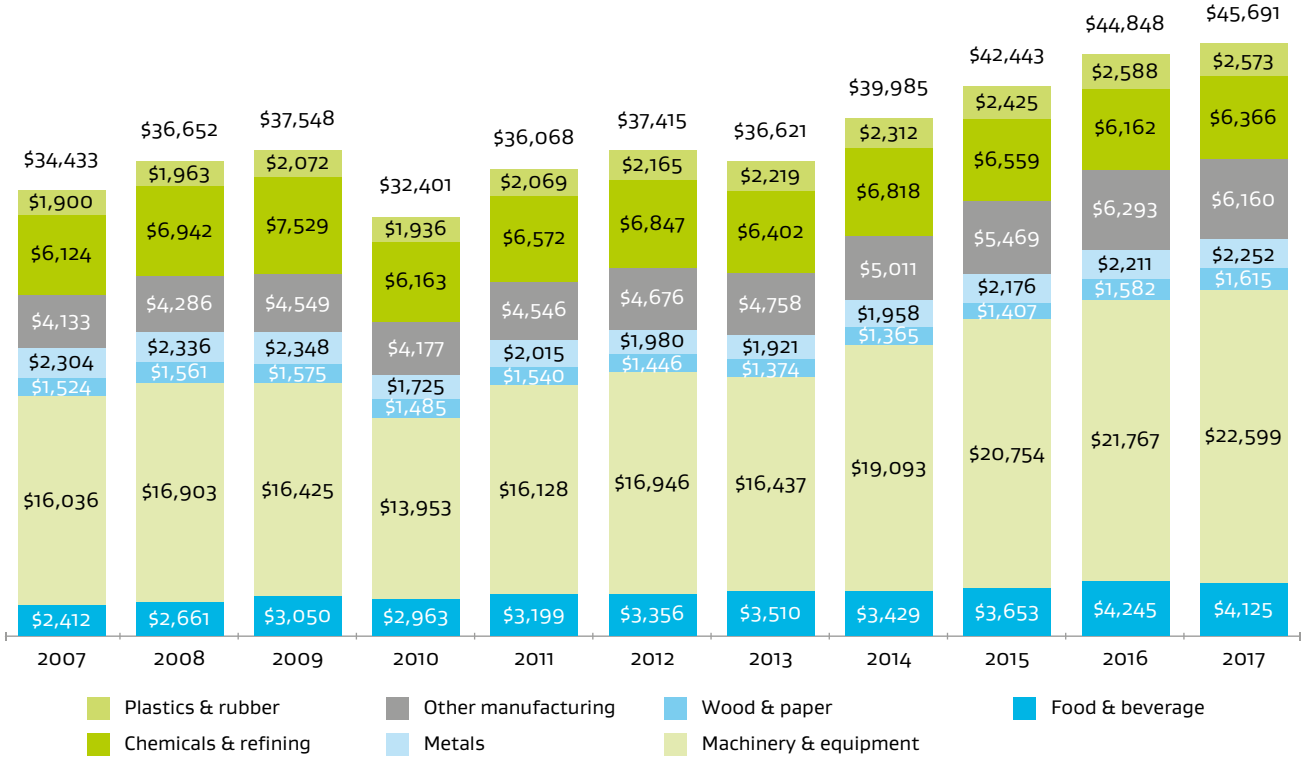


Source: Exports data, Statistics New Zealand

‘Machinery and equipment’ imports make up almost half of all New Zealand’s manufactured goods imports

Manufactured imports by category

NZ$ millions, year end June, 2007-2017



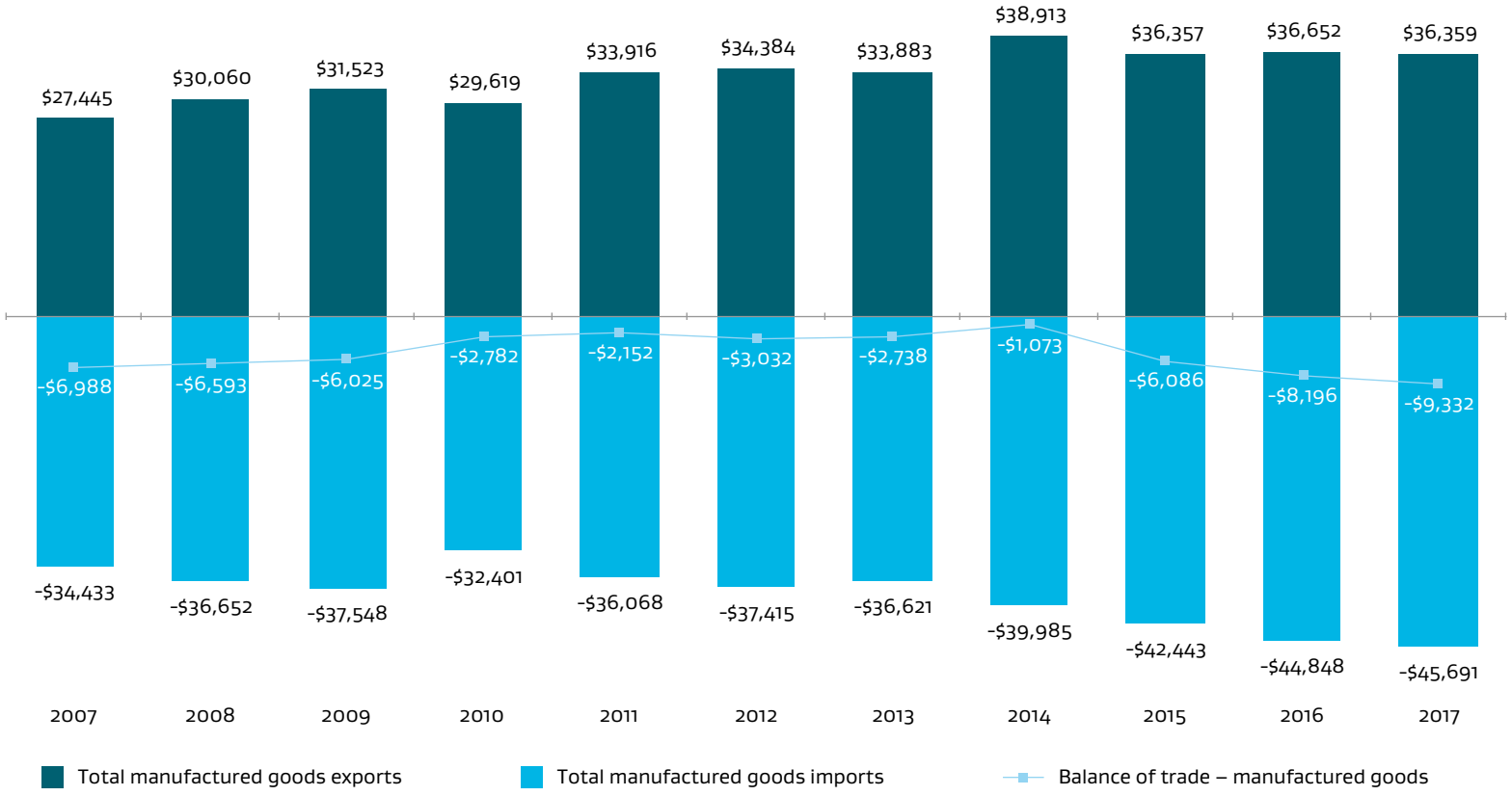
	2007-2017 CAGR	2016-2017 CAGR	ABS change ($m)
	3%	2%	$11,258
Plastics & rubber	3.1%	-1%	$673
Chemicals & refining	0.4%	3%	$242
Other manufacturing	4%	-2%	$2,027
Metals	-0.2%	2%	-$52
Wood & paper	1%	2%	$91
Machinery & equipment	3.5%	4%	$6,564
	49% – This will include items such as consumer electronics		
Food & beverage	6%	-3%	$1,713

Source: Imports data, Statistics New Zealand

New Zealand consistently imports more manufactured goods than it exports

Balance of trade – manufactured goods

NZ$ millions, year end June, 2007-2017

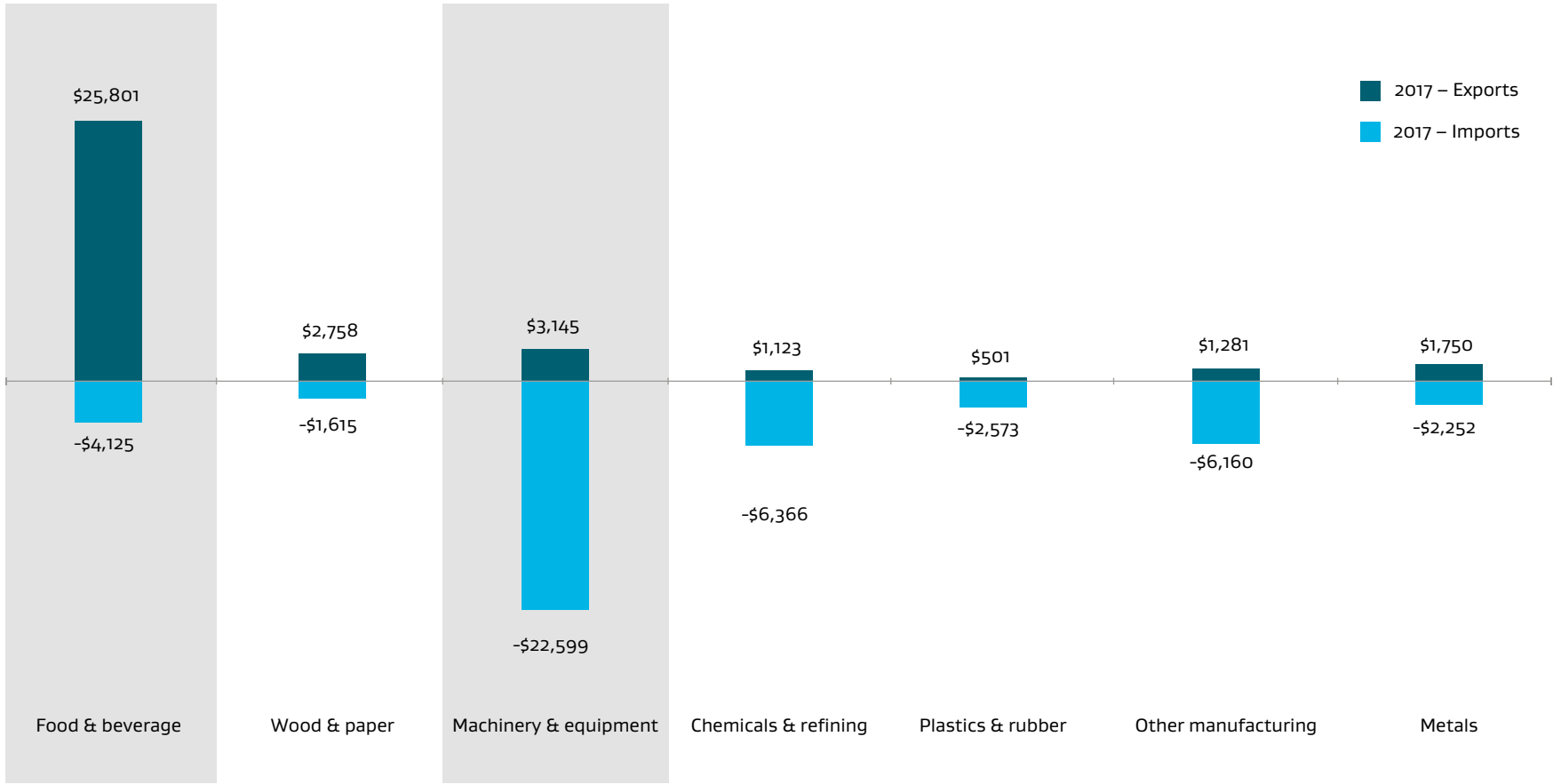


Source: Exports and imports data, Statistics New Zealand

‘Food and beverage’ manufacturing had the largest positive balance of trade* for New Zealand in 2017; ‘machinery and equipment’ had the largest negative balance

Balance of trade – manufactured goods by subsector

NZ$ millions, year end June, 2017

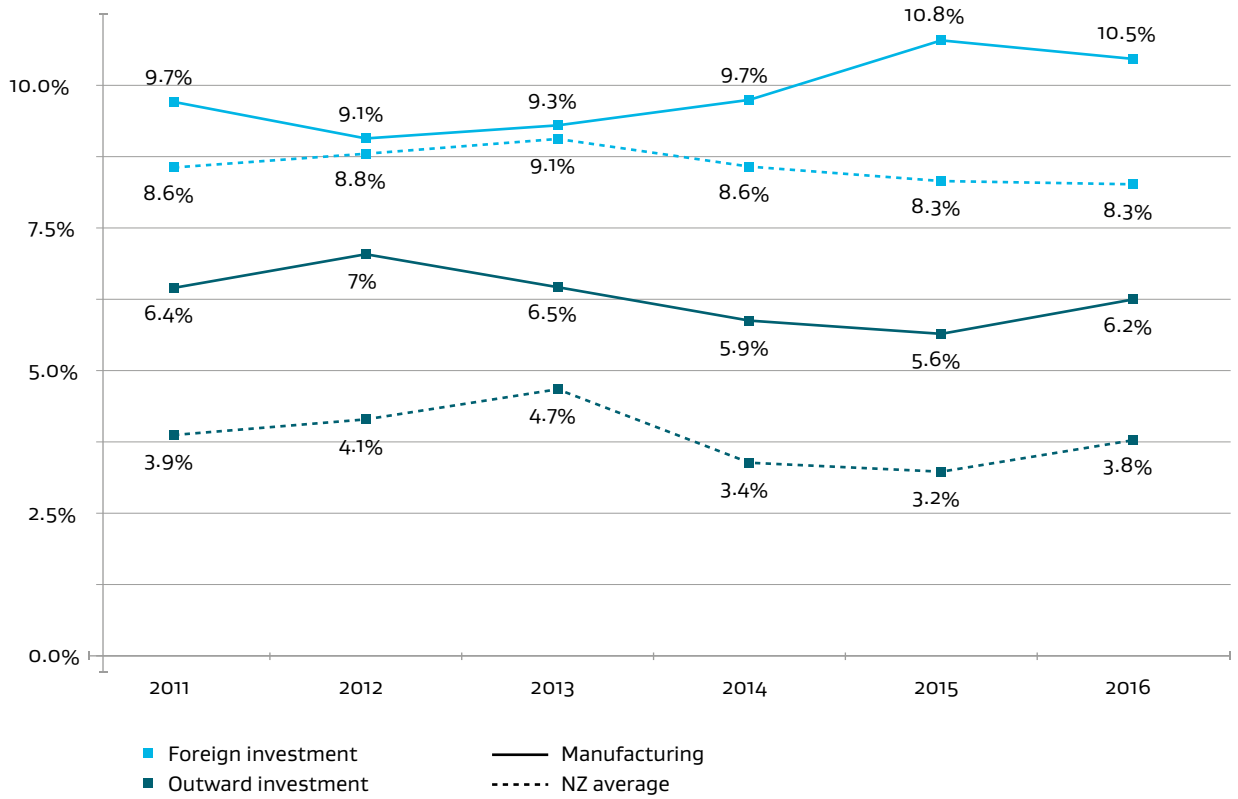


Source: Exports and imports data, Statistics New Zealand

* A positive balance of trade means the value of exports is greater than the value of imports.

Manufacturing firms have a higher rate of both foreign investment and outward investment than the New Zealand average

Foreign investment in New Zealand firms; outward investment by New Zealand firms
% firms, 2011-2016



In 2016, individuals or businesses located overseas held an ownership or shareholding interest in 522 New Zealand manufacturing firms

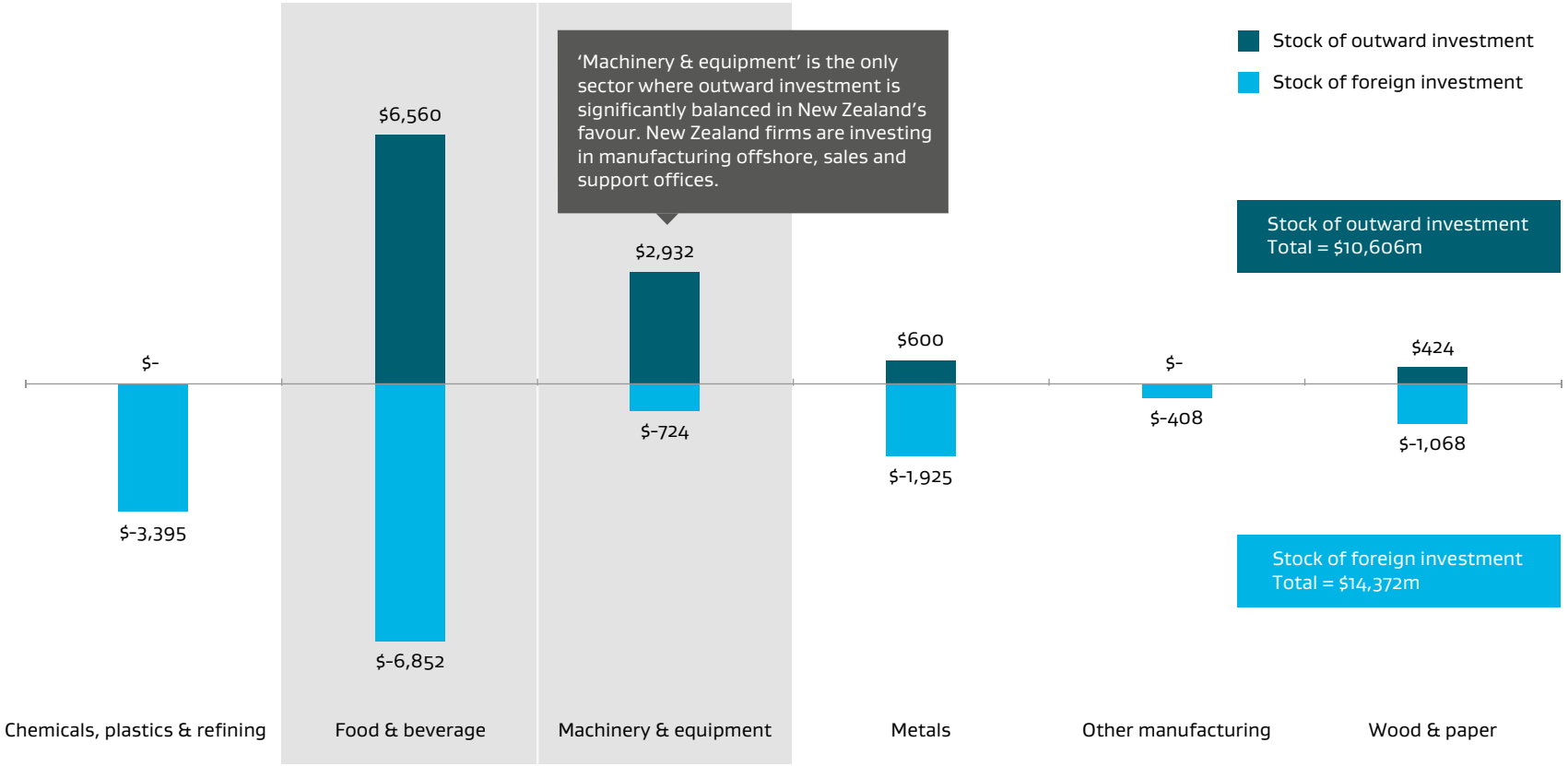
In 2016, 312 New Zealand manufacturing firms held an ownership or shareholding interest in a firm located overseas (this includes having its own branch, factory, subsidiary or sales office)

Source: Business Operations Survey, Statistics New Zealand

‘Machinery and equipment’ firms’ outward investment is four times the value of foreign investment in ‘machinery and equipment’ firms

New Zealand ‘food and beverage’ firms have $6.5 billion in outward investments

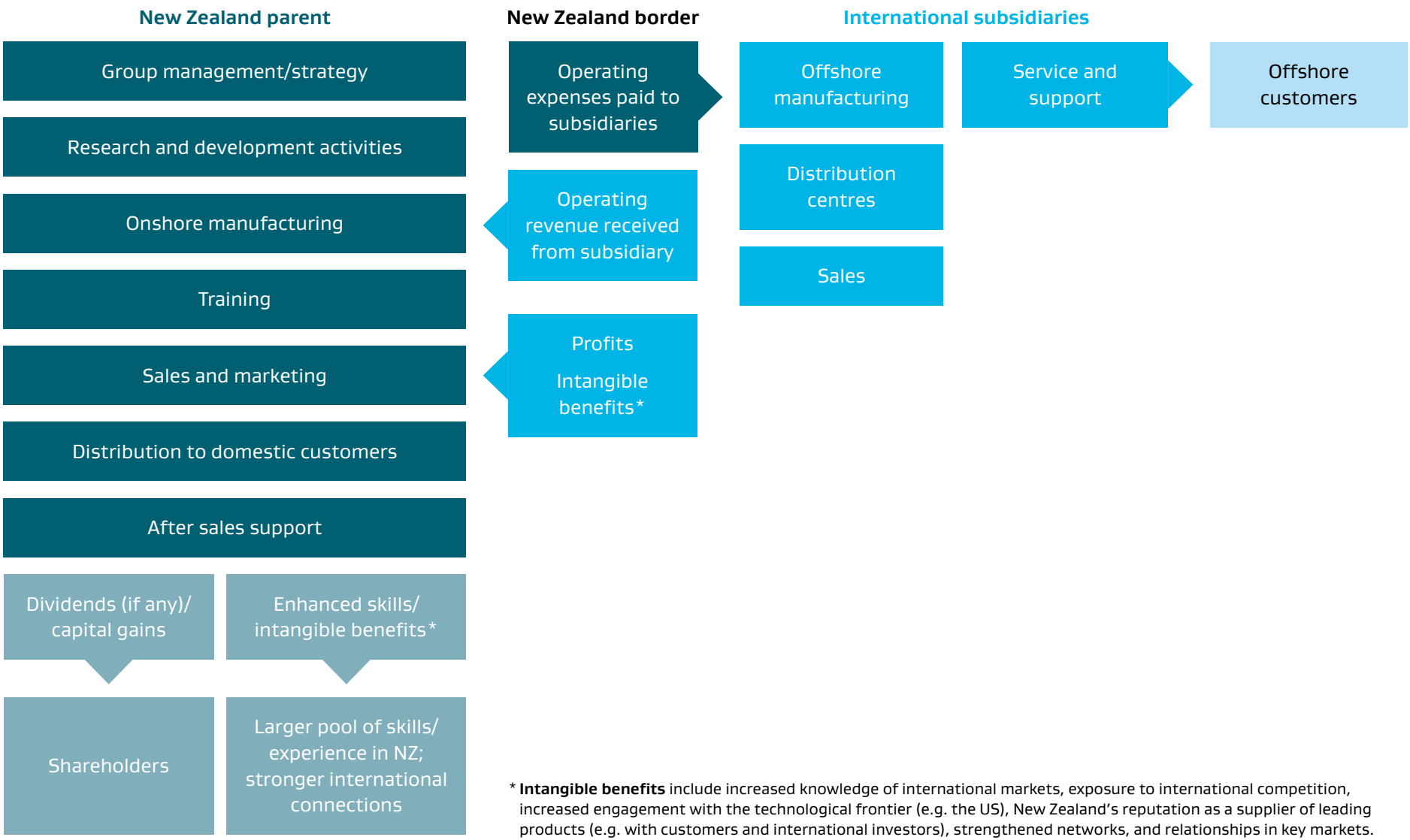
Stock of foreign investment in New Zealand; stock of outward investment from New Zealand
NZ$ millions; as at March 2016



Note: Due to data limitations, ‘chemicals and refining’ and ‘plastics and rubber’ are shown as one subsector – ‘Chemicals, plastics and refining’.

Source: Statistics New Zealand, MBIE analysis

A simplified model of a New Zealand firm engaged in offshore manufacturing



* **Intangible benefits** include increased knowledge of international markets, exposure to international competition, increased engagement with the technological frontier (e.g. the US), New Zealand's reputation as a supplier of leading products (e.g. with customers and international investors), strengthened networks, and relationships in key markets.

There are a number of reasons that New Zealand based manufacturers may choose to move all or part of their operations offshore

Example firm	Offshore operation	Strategic consideration/s
Fisher and Paykel Healthcare	Established a greenfield manufacturing operation in Mexico, in addition to its New Zealand operations.	› Disaster recovery policy and patient risk › Forex hedging policy › Supply chain compression › Possible FTA benefits
Methven	Purchased a Chinese company that was manufacturing some of Methven's legacy products.	› Existing production and business relationship › Opportunity to improve margins
Scott Technology	Acquired manufacturing facility in China, as well as businesses in Melbourne, Germany, and the US.	› Ability to take advantage of opportunities within Chinese and wider Asian markets › Geographic and market diversification › Foreign presence allows for closer connection with overseas customers
Kowtow	Manufactures clothing in India.	› Keeping labour costs manageable › Keeping control and oversight of production chain to ensure ethical treatment of workers › Access to sustainable, high quality cotton
Argenta	Established a greenfield manufacturing plant in Fort Dodge, Iowa in addition to operation of two American-based research facilities and acquiring a Scottish manufacturing plant.	› Proximity to key US and European markets. › Support development of New Zealand R&D capabilities with increased market opportunities › Increase capacity to match rising demand

Beyond exports: participation in global production networks

Global Production networks

Global trade is increasingly complex and intertwined across and within companies and countries. These global value chains and production networks are largely dominated by transnational corporations. There appears, however, to be ample opportunities for niche players to participate.

A notable example of a production network is the iPhone, the components of which are manufactured in twenty different countries, with the final product assembled mostly in China. New Zealand's participation in this network is through Buckley Systems, which supplies machinery used in the manufacture of more than 90 percent of the world's silicon chips, including those used in iPhones. A business can be a centre of gravity for a production network, e.g. Apple, or a participant, e.g. Buckley Systems.

New Zealand has traditionally operated a 'produce locally and export' model, which is one hallmark of a commodity business. This has involved an element of 'ship and forget'.

Increasingly New Zealand manufacturers are moving away from a pure 'produce locally and export' mind-set towards one focused on participation in global production networks. This development is driving an increase in the export of complex products. But it also means that some New Zealand firms will grow large international businesses based on technology, innovation, design or brand, that may not export any goods from New Zealand at all, as manufacturing and distribution is all managed offshore.

Identifying profitable opportunities to participate in the international production network is a key challenge. The more complex the product (including multi-ingredient food products), the more complex the production network (e.g. the Toaster Project, see page 28).

Start-up New Zealand businesses can achieve scale through accessing different parts of an existing international production network and utilising its key capabilities, eliminating the need to invest in developing these themselves (see Ubco example opposite).

Examples of NZ firms' participation in global networks

Sistema (Plastic containers): Sistema import raw material (polyolefin). Value is added through strong skills in design, innovation and manufacturing. A wide range of plastic containers are exported.

Icebreaker (Outdoor clothing and apparel): Icebreaker source merino wool from New Zealand which is then exported to China for manufacture. It adds value through strong skills in design, brand, marketing and supply chain management. Icebreaker distribute to 4,500 retailers across more than 43 countries. New Zealand exports wool, China exports clothing. A profitable and growing Icebreaker pays good prices to merino growers.

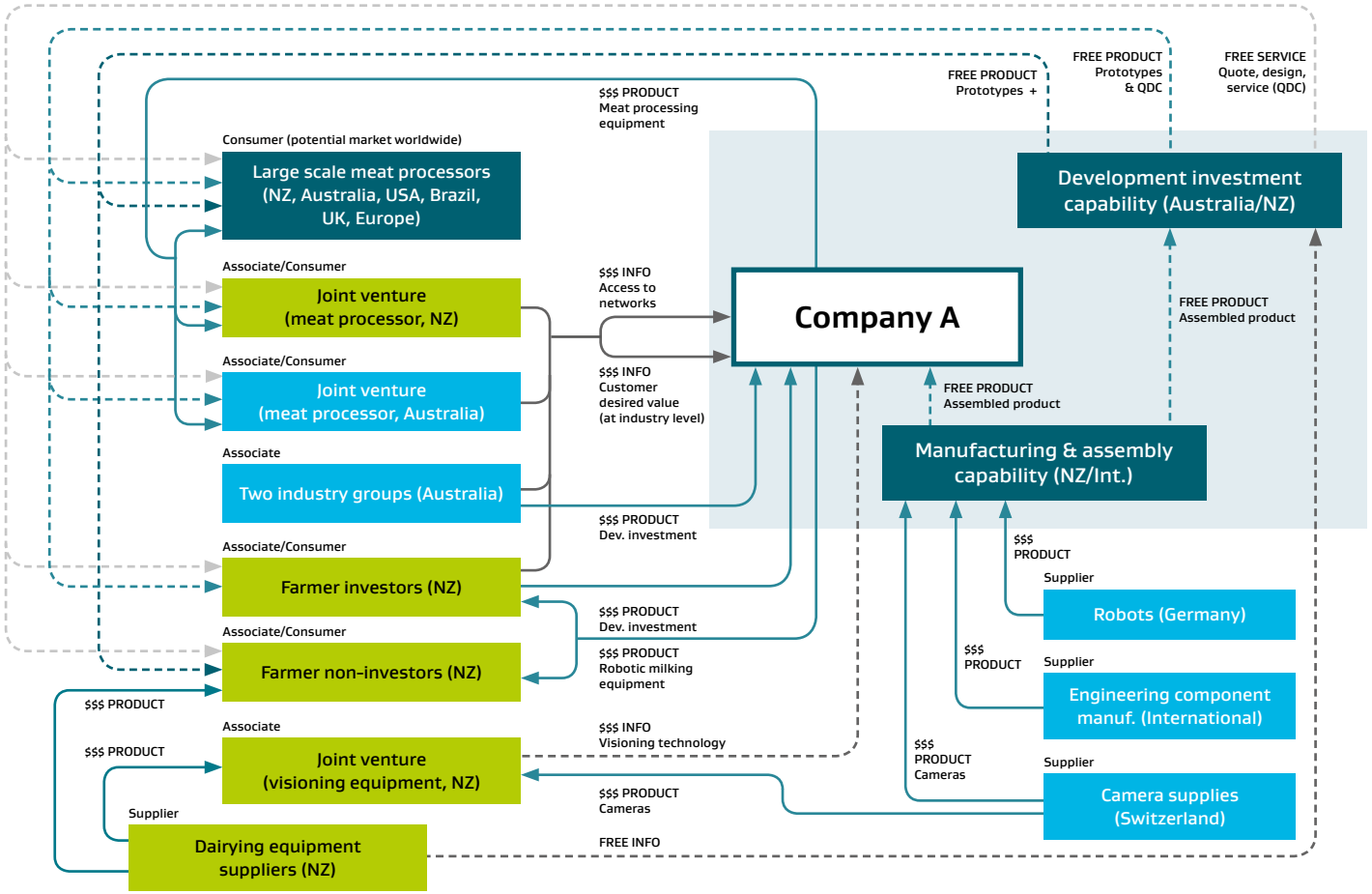
Ubco (Automotive): Ubco applied New Zealand design and innovation to develop an electric farm-bike. The major components of the Ubco are cherry-picked from the many electric bicycle/motorcycle parts manufacturers clustered near Kunshan, China. Scale manufacturing to supply the US and other markets is offered by Chinese electric scooter maker Yadea, utilising capabilities not available in New Zealand. New Zealand builds an international business based on innovation, performance and brand. China increases exports of electric farm bikes.

Fonterra (Dairy): Fonterra operates an integrated global supply chain from the farm gate to global consumers. It manufactures commodity products and added value products (consumer and food service) in New Zealand for export, and at manufacturing sites in Australia, Europe, Asia and South America. Added-value products may be manufactured in-market, e.g. whey protein (Netherlands); infant formula (Australia).

Fisher and Paykel Appliances (Appliances): Fisher and Paykel Appliances (F&P) maintains research and development in New Zealand and continues to manufacture specialist componentry and production equipment in Auckland. F&P participates in the global appliance production network by supplying smart technologies such as direct drive motors and compressors to other manufacturers. F&P appliances are manufactured in Thailand.

Global production networks are complex, internationally interconnected webs across which products, services, money and information flow

Example production network: industrial automation company



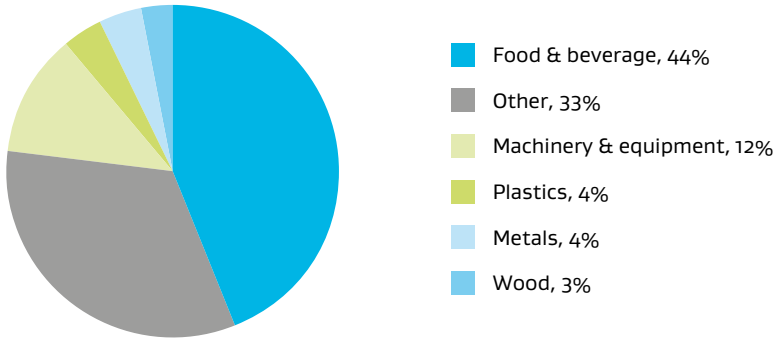
Source: New Zealand Institute of Economic Research report on global value networks. Used with permission.

New Zealand Trade and Enterprise (NZTE) works with manufacturing companies in New Zealand to assist them to grow their business internationally

NZTE works with companies at all stages of export development and matches its support to the needs of businesses. To achieve the most impact and use NZTE resources most effectively, NZTE has categorised the customer base and focuses on companies that are committed to international growth.

NZTE provides high engagement with businesses that are strategically exporting under a committed plan to accelerate their international growth. **NZTE currently has 442 high engagement Customers in the manufacturing sector.** NZTE helps like-minded businesses to connect and build strategies to grow internationally together through formal Coalitions. **NZTE is currently working with six manufacturing Coalitions.**

NZTE manufacturing Focus Customers by subsector



NZTE's lighter touch engagement Customers are at an earlier stage in their international journey and are segmented accordingly, into 'Build' and 'Start'. **NZTE currently has 2,579 low engagement Customers in the manufacturing sector.**

NZTE partners high engagement Customers and Coalitions with a dedicated Customer manager, who is responsible for working with the company. Build and Start Customers have less intense engagement with NZTE but are supported with the practical tools, knowledge and advice to export.

NZTE delivers services to its manufacturing Customers in New Zealand to grow international markets. These services include global market research, access to international business development managers and identifying in-market opportunities to Customers.

NZTE provides capability building expertise to strengthen a customer's business. Workshops and connections to expert advisors help companies focus on export growth, company strategy and governance, and design led innovation.

Through the International Growth Fund, NZTE supports manufacturing companies with specific international projects that are considered beyond business-as-usual, involving either new international activities or adding value to existing activities. In addition, NZTE provides investment readiness advice and connections to local and international investors.

Industry commented on the challenges presented by international trade

"Where there is money to be made ultimately [low-cost manufacturers] will follow and they will commoditise that market as quickly as they possibly can. . .We realised that we would have to use our technology in a way or in a market that would not be easily accessible to the low labour cost countries."

Senior executive, 'machinery and equipment' firm

"There are tariffs in countries that we sell to and we have to pay them."

Manager, 'wood and paper' firm

"[Companies] are now manufacturing their product in China so then they print there as well. So every time a manufacturing base goes offshore there's an element of print that disappears with it."

Senior executive, 'other manufacturing' firm

"There's 600 million tons roughly of Chinese steel exported. That is what has driven the price and obviously the world steel industry has responded to that through exercising legitimate rights under WTO Rules via trade action generally."

Senior executive, 'metals' firm

"Certainly from a geographic perspective being in New Zealand is a challenge. For the Europeans in particular the green component in terms of the carbon footprint is very, very important so as an organisation we need to show that we are sustainable."

Senior executive, 'chemicals and refining' firm

Case Study: Bobux

Bobux was established in 1991 in Auckland. The company manufactures shoes for babies and young children made from soft leather and suede to allow healthy foot development. Bobux have invested in research and worked with foot experts to develop their product.

Bobux have a strong focus on innovation and their brand is built on being experts in their field.

Bobux is a small team that works closely with experts to develop leading products. Bobux has a focus on innovation and is beginning to look at integrating new technology into their products. The company is currently working with Auckland University of Technology on a project around in-shoe sensors for understanding how the shoe is performing around the foot.

Bobux works hard to differentiate their brand for its quality and benefits for healthy foot development. In the eyes of customers, Bobux is often competing with larger shoe manufacturers that are producing at scale, without as much of a focus on healthy foot technology. Bobux is working hard to establish themselves as a brand leader.

Bobux has a strong global footprint and is taking advantage of the shift towards greater online retail.

Bobux exports into the UK, Europe, Australia, the USA and to a lesser extent into Asia and the Middle East. The changing nature of the retail sector has meant that more of their sales are moving online – in 2016 14.5 per cent of their worldwide sales were made online. The move online allows companies like Bobux to control more of their margins and pricing rather than going through established retailers.

Bobux is one of NZTE's Focus Customers, and NZTE has provided meaningful assistance to Bobux in accessing new international markets and increasing exports.

Bobux have moved their manufacturing offshore in order to remain internationally price competitive and to take advantage of skills and supporting industries that are no longer available in New Zealand.

When it was established, Bobux's manufacturing took place in East Tamaki and Wellington. Bobux moved most of its manufacturing facilities offshore nine years ago, to five contract manufacturers in Indonesia. This was largely influenced by the challenge of manufacturing their shoes in New Zealand at prices demanded by retailers.

The company also noticed a decline in the clothing and footwear manufacturing sectors in New Zealand. This meant that a lot of the skills and supporting industries needed to manufacture their shoes are no longer available in New Zealand. Bobux has a dedicated staff member in each of its contract factories whose role is to monitor for quality control.

BOBUX

Case Study: Enatel

Enatel is an electronics technology manufacturer with three divisions:

- Enatel Energy – a power conversion and electronics specialist, supplying DC power, standby power and industrial power systems to customers in the telecommunications, transportation, ICT and energy sectors.
- Enatel Motive Power – designs and manufactures compact, high frequency modular battery chargers for charging equipment such as forklifts.
- EnaSolar – New Zealand's only designer and manufacturer of solar inverters, the power electronics that convert energy from solar panels into safe, usable power.

Enatel operates in global niches by using their technology in a way that is not accessible to low-cost, large-volume global manufacturers.

Enatel creates high-tech products and is constantly looking for ways to distinguish themselves from low-cost competitors. For example, EnaSolar produces solar inverter products that convert the DC power generated by solar panels into AC power for use in homes. The inverters have embedded software that allows customers to use applications to monitor their electricity usage and generation.

This is a much more niche product than solar panels themselves, which are mostly manufactured by large Asian manufacturers in high volumes.

Enatel also sells to markets where barriers, such as fragmented distribution into different states in the USA, deter large international manufacturers.

New Zealand's reputation as an honest, transparent country to do business with has acted as an advantage to Enatel.

Enatel has built relationships with some customers based on New Zealand's international reputation. For example, they sell to customers in countries that are aware of the security risks associated with electronic equipment and where a high level of trust is needed to maintain relationships.

Automation in Enatel's manufacturing processes is increasing and the company expects this to continue.

Enatel is prepared for the reality that many simple jobs will be automated in the future. Automation is necessary to improve productivity by taking the labour cost out of simple processes and speeding up production times.

Advances in technology are also providing new product opportunities for Enatel. The company sees new markets that are emerging as a result of advanced technology as an important growth opportunity for their business. Enatel incorporates digitisation into its products to provide data to customers. For example, their battery chargers provide analysis on the health of the battery.

enatel

SECTION 8

Financial performance

Financial performance: Key points

› Revenue has increased across all manufacturing subsectors in the last five years.

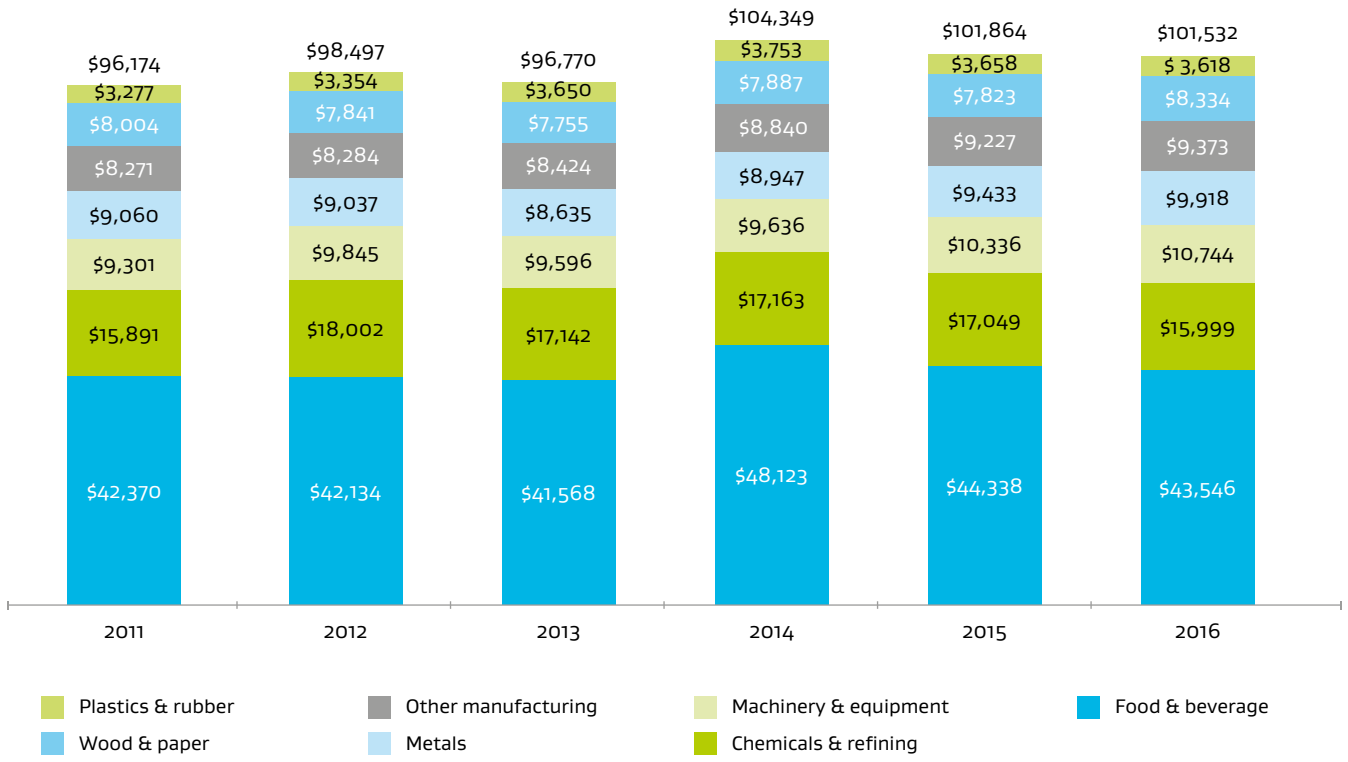
› Close to 40% of manufacturing firms invested in expansion in 2016, more than the New Zealand average (30%); 56% of 'chemicals and refining' firms invested in expansion in 2016.

› Average return on equity for the manufacturing sector exceeds the New Zealand average.

Revenue has increased across all manufacturing subsectors in the last five years

The ‘machinery and equipment’ subsector added $1.4 billion in revenue

Revenue by subsector
NZ$ millions, 2011–2016

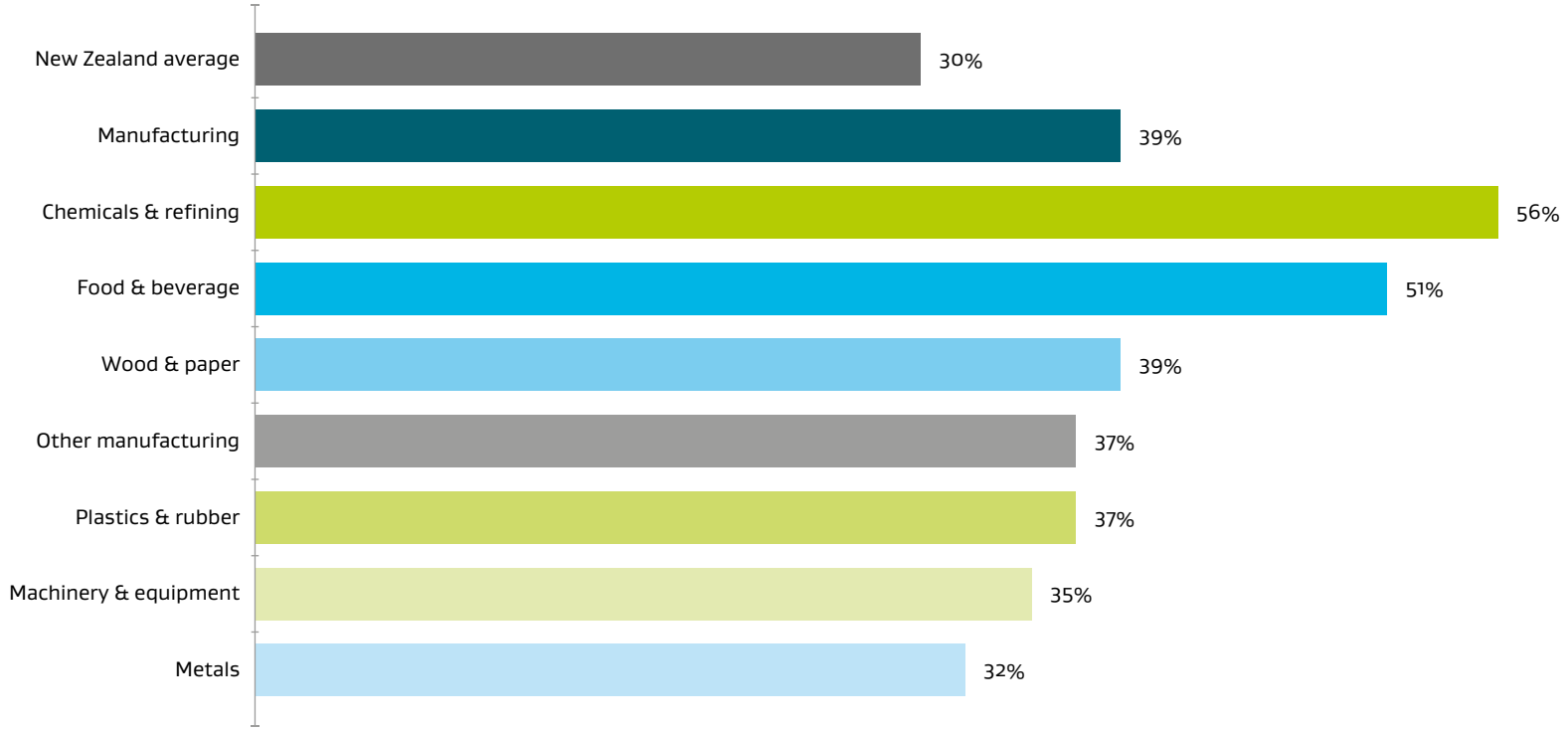


	CAGR 2015-16	CAGR 2011-16	ABS 2011-16
Food & beverage	-0.3%	1.1%	$5,358
Plastics & rubber	-1.1%	2%	$341
Other manufacturing	6.5%	0.8%	$330
Machinery & equipment	1.6%	2.5%	$1,102
Metals	5.1%	1.8%	$858
Wood & paper	3.9%	2.9%	$1,443
Chemicals & refining	-6.2%	0.1%	$108
Total	-1.8%	0.5%	$1,176

Source: Annual Enterprise Survey, Statistics New Zealand

39% of manufacturing firms have invested in expansion, more than the New Zealand average (30%)

Investment in expansion
% firms, 2016

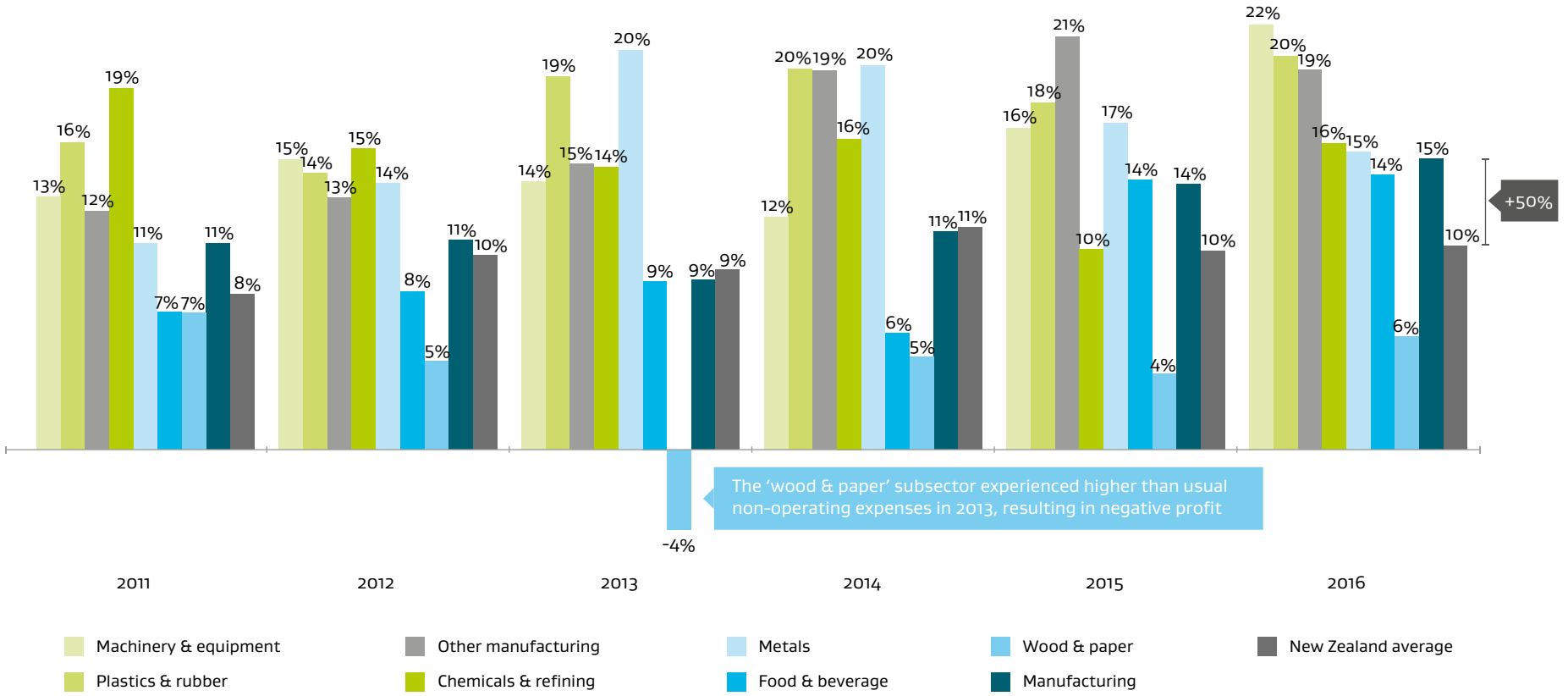


Source: Business Operations Survey, Statistics New Zealand

On average, return on equity for the manufacturing sector as a whole exceeds the New Zealand average

Return on equity by subsector

%, 2011–2016



Source: Annual Enterprise Survey, Statistics New Zealand

Case Study: Wyma Solutions

Wyma manufactures a range of post-harvest, pack house equipment for customers in the produce industry. This includes equipment for conveying, grading, washing and packing produce. Wyma has manufacturing plants in Christchurch, Europe and China.

Wyma operates in Europe and China to be cost effective and close to markets.

The biggest challenges of manufacturing in New Zealand are scale, distance from markets and the cost of manufacturing due primarily to higher overall costs in New Zealand compared to the rest of the world. Wyma considers that manufacturing in New Zealand will always be relatively low volume. New Zealand's size is the reason manufacturers turn to relatively low-volume, bespoke manufacturing in order to compete internationally.

Wyma is constantly innovating to remain ahead in international markets.

Wyma has a lot of intellectual property tied up in the design of the high-tech machines that they manufacture and the required level of employee expertise to manufacture these. However, the company does not attempt to patent many of their products due to the relatively high cost per unit sold and the inability to amortise the cost over large volumes. Instead Wyma find it more effective to continually innovate in order to remain competitive.

Wyma has a high R&D spend. This investment is focused heavily on the development side of R&D by improving existing products and processes around bespoke design, rather than developing new machines.

Securing skilled staff is a challenge for Wyma because of their niche market.

There are only five to ten major manufacturers of the same type of pack house equipment in the world. This means that there is a shallow labour pool of appropriately skilled people for Wyma to draw from in New Zealand. They recruit staff from overseas and train New Zealanders to develop the skills and specific product knowledge that they need.

Like many other manufacturing companies, Wyma offers a range of wraparound services to complement its products.

Wyma offers services including maintenance of clients' equipment, conducting regular services on their machines, the sale of spare parts and design services. Wyma estimates that these additional services make up around 10 per cent of their revenue.

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Case Study: Grayson Engineering

Established in 1972, Grayson Engineering is a market leader in the steel fabrication industry. In addition to steel fabrication, the company has its own in-house steel painting and CAD drawing capabilities. Grayson services the commercial and industrial markets in New Zealand.

Grayson Engineering considers that there are a number of advantages to manufacturing in New Zealand.

One of the advantages of being close to market for Grayson Engineering is that they are able to engage early with contractors to build quality and design elements into their steel products. The company is also able to meet New Zealand's structural standards, for example meeting New Zealand's specific seismic standards.

Grayson Engineering considers that competition is quite high in New Zealand. Therefore early, local engagement can provide an edge in the market as it provides more efficiencies and the ability to make last minute changes to designs if requested by customers.

Investment in innovation is essential for enhancing Grayson Engineering's productivity.

Grayson invests heavily in state of the art machinery in order to continually improve its productivity. The company considers this an essential way of remaining competitive against both local and international manufacturers.

In 2017, Grayson Engineering is investing several million dollars in their own painting facility. This will be established next to their manufacturing plant in order to reduce the time currently spent transporting steel to and from off-site paint shops across Auckland.

Grayson Engineering takes on apprentices to assist in meeting skills shortages in New Zealand.

The company is currently employing four apprentices who will be trained up as qualified trades workers. Grayson Engineering considers they will need to continue to train roughly four apprentices every year for the next five to six years in order to fill existing skills shortages.

The company is part of The Southern Initiative with Auckland Council, which stimulates social and community innovation in South Auckland. This includes training and employment, and Grayson works with the Southern Initiative to identify people for apprenticeships. The company works with local high schools to give young people work experience with the view to training them and working towards an apprenticeship. Grayson Engineering is also working with a local polytechnic to design an all-encompassing course to equip workers with all of the essential skills that they need to work in the steel fabrication industry.

Grayson Engineering's manufacturing processes are heavily automated and the company looks for trades qualified staff who can be trained in operating computer technology.

SECTION 9

Beyond commodities

Beyond commodities: Key points

- New Zealand is part of the constantly evolving global economy. Change is driven by technology and global markets.
- Manufacturing in New Zealand has undergone significant, ongoing, changes since the 19th century.
- The development of new industries takes time. Typically there is a long period of gestation as the capabilities required for success - in firms, and in the supporting ecosystem – are acquired or developed. Both private and public organisations are usually involved.
- Different industries require different capabilities.
- Once a new activity achieves some scale and the ecosystem matures, growth is likely to accelerate.
- Competition and changing market dynamics are the most powerful forces driving development and change. If production of a particular good remains profitable and delivers growth, there is little incentive for firms to invest in diversification, as this is both costly and risky.
- Development, e.g. from commodity production to value-added production, occurs in industries at different times.

Commodities are products that are differentiated primarily on price, rather than brand or quality

Commodities

- A commodity is a product where there is little variation in quality or performance from one producer to another. Supply and demand is the key determinant of price. Most commodities are traded on commodity exchanges.
- All countries produce and, to a lesser or greater extent, export a range of commodities.
- By contrast, a value-added or branded product is one where the quality and features may be completely different depending on the producer. Hence the market may pay a premium for unique features, perceived value, brand or provenance.

Commoditisation

- Commoditisation is the process by which goods that are initially differentiated in the market through uniqueness or brand, end up becoming commodities in the eyes of consumers. For example, arguably smart phones are becoming commoditised, as the features and performance are similar across brands.
- Once a product category becomes commoditised, consumers tend to buy on price. Commoditisation can be avoided through constant innovation and new product development.
- In most cases a commoditised category will still include premium brands, e.g. Warehouse shoes versus Jimmy Choo.

Selected commodities traded globally	Dairy products traded on Global Dairy Trade (Dairy Auction)	Selected commodities exported by New Zealand (other than dairy)	Examples of commoditised products	Examples of value products exported by New Zealand
› Corn	› Whole milk powder	› A–K grade logs	› Home appliances	› Goat and sheep infant formula
› Rough rice	› Skim milk powder	› Aluminium	› Televisions	› Medical technologies
› Wheat	› Butter	› Steel	› Fast fashion	› Pharmaceuticals
› Soy beans	› Butter milk powder	› Methanol	› Flash drives	› Mixed chocolate/ chocolate bars
› Cocoa	› Cheddar	› Frozen Beef	› Keyboards	› Cosmetics/skincare
› Coffee	› Lactose	› Frozen Lamb	› Printers	› Agri-technologies
› Brent crude	› Rennet casein	› Wood pulp and paper	› Auto parts	› Marine electronics
› Ethanol	› Anhydrous milk fat	› Crude oil	› Toasters	› Automated systems and robots for assembly lines
› Palm oil		› Gold	› Home improvement tools, e.g. electric drills	
› Aluminium		› Silver		
› Steel		› Wool		

New Zealand manufacturing has been transitioning to value for 30 years; products are differentiated through innovation, performance, brand, quality, niche or service

Selected examples of industry transitions, 1970s–2017

Protectionist period 1970s	Drivers for change	Internationalisation/innovation period 2000s	Examples/potential
Assembling of **cars** from imported components for local market e.g. Todd Motors	› Protections eliminated › Lack of scale › Cheaper imports, including used vehicles › Closer Economic Relations (CER), other FTAs creating export opportunities	Design and manufacture 'mobile solutions' for specific needs, e.g. in the medical, emergency, tourism and transport sectors, such as fire appliances, ambulances, motor homes, electric motorbikes, autonomous vehicles.	› Fraser Engineering › Action Manufacturing › UBCO › HMI Technologies › Ongoing growth potential
Large number of **apparel manufacturers**, e.g. Lane Walker Rudkin, Pacific Brands	› Many sub-scale factories › Reduction of tariffs › Competition from low-cost producers › CER creating larger market for designer fashion › Access to lower cost manufacturing (e.g. in China) enabling low fixed capital business model	Designer fashion, street fashion, outdoor clothing, some manufacturing in New Zealand. Emerged onto global stage with 'New Zealand Four' showing at the 1999 London Fashion Week (Zambesi, Nom'D, Karen Walker, World).	› Kate Sylvester › Untouched World › Swazi › Juliette Hogan › Harman Grubisa › Potential for large brand businesses, but significant manufacturing in New Zealand unlikely
Consumer electronics, e.g. televisions, radios, stereos, for local market	› Protections eliminated › Reduction in tariffs › Cheaper imports from scale assemblers/producers › Existing skill-base refocused on innovation	Wide range of electronic components and finished goods targeting specific niches, e.g. marine electronics. New entrants seeking profitable participation in international production networks.	› 4RF (digital microwave radios) › Fusion Entertainment (high end marine 'audio solutions') › BEP Marine › Navico Auckland › Ongoing growth potential
Sawn timber for construction and other applications	› On-going search for high value product categories that can add value to logs › Very high demand for logs from China and India makes economics of New Zealand wood processing challenging	Emergence of engineered lumber products for construction and other applications. Future potential for assembly line manufacture of houses.	› XLam (cross laminated timber) › Nelson Pine (laminated veneer lumber) › Ongoing growth potential

Competition and changing market dynamics globally are the most powerful forces driving development and change

Protectionist period 1970s	Drivers for change	Internationalisation/innovation period 2000s	Examples/potential
Processed packaged or frozen/ canned foods for the local market, e.g. Griffins, Wattie's	› Existing skills through 100 years of production for the local market › CER/other FTAs creating new opportunities › Establishment of Food Standards Australia New Zealand (FSANZ) creating common Australasian compliance regime › Consolidation of supermarket chains in New Zealand from three to two driving manufacturers to look for export opportunities › Entry of Aldi into Australia providing export opportunities	Increasing focus on packaged retail products based on innovation, brand, appealing to consumer mega-trends, e.g. health and wellness, convenience, indulgence. Nutraceuticals and natural products appealing to the health conscious consumer. High performance products for food service.	› Cookie Time › EBOS Group (owns Red Seal) › Greenmount Foods (value-added component food products) › Comvita › Barker's › Jack Link's › Whittaker's › Sea Dragon › Vitaco › Abe's Bagels › Pic's Peanut Butter › Significant growth potential
Bulk dairy products for export (Dairy Board). Effectively an industrial dairy production system underpinned by low cost production. Model has persisted into the 2010s	› Consolidation of dairy industry to create scale (Fonterra) › Burgeoning middle class in emerging economies creating demand for protein driving increased production › Food safety concerns e.g. melanin scandal › Plentiful high quality ingredients to support value-added manufacturing › Volatility of commodity prices › Lower transport costs and new packaging technologies enabling exports of perishable products (yoghurt) and fluid milk (UHT)	Multiple waves of new dairy firms in last 10 years. Range of global investors investing in New Zealand dairy production and processing, with a focus on dairy nutritionals and infant formula. Incumbents, e.g. Westland, adopting value-add strategies to mitigate commodity volatility. Range of innovative new products launched. Emergence of goat and sheep milk dairy. $2.3 billion in identified investment in plant and equipment focusing on value-added products since 2015.	› The Collective › Lewis Road Creamery › Synlait › Dairy Goat Cooperative (pioneered goat infant formula) › Blue River Dairy › Spring Sheep Dairy › A2 infant formula › Oceania Dairy › Fonterra Consumer and Foodservice › Market has determined that adding value is the future for natural dairy

Transitioning to the value-added/branded export business requires different skill-sets and capabilities – in firms and institutions – that are new to New Zealand

Example: agribusiness low cost commodity drivers versus value-added branded drivers

Different businesses

Low cost commodity (ingredient suppliers)

Key drivers

- Low cost or highly productive land
- Low cost or highly productive labour
- Efficient farming systems
- Efficient logistics
- Must constantly improve production efficiency every year
- Fewer, but larger processing facilities
- Economies of scale (e.g. 'largest spray driers in the world')

Risks

- No defensible position as vulnerable to technology or systemic shifts (e.g. plant based protein)
- Vulnerable to consolidation of competitors changing their economics
- Vulnerable to market volatility

New Zealand has deep knowledge and mature capabilities in this business after 120 years of experience and investment by both private and public sector players.

Value-added branded (packaged products for retail sale)

Key drivers

- Focus on innovation, new product development, complex products and/or premium position
- Access to relevant skills (technical, marketing, operations, sales)
- Ability to build strong defensible brands
- Ability to gain market share (number 1 or number 2, or niche player)
- Access to market research and intelligence, consumer insights and testing
- Access to distribution
- Access to a wide range of technologies e.g. process, preservation, packaging
- Capital investment
- Scale

Risks

- Late to the game (versus e.g. the Netherlands, Denmark, Germany)
- Key NZ firms may lack required culture (entrepreneurial, fast moving, sales focused, able to play local politics)
- Need to build in-market team of locals (time, commitment, resources)
- Requires patient investment over a long time frame
- New Zealand local market participants underestimating competitive ferocity of offshore markets, e.g. in Asia

All parts of the system, including government, need to 'learn the business' and develop the necessary supporting capabilities.

Source: Coriolis Research, various reports

Development of a new industry takes time; there is often a long gestation period before material growth occurs

Path dependence (or history matters)

Economies develop specialisations

Path dependence is the fact that the way the economy has developed over time through private investment and government policy, places constraints on the way the economy can develop in the future. To use an analogy, a lawyer with deep knowledge in the practice of commercial law is not easily going to be able to switch to practicing successfully as a criminal defence lawyer. They are different competencies.

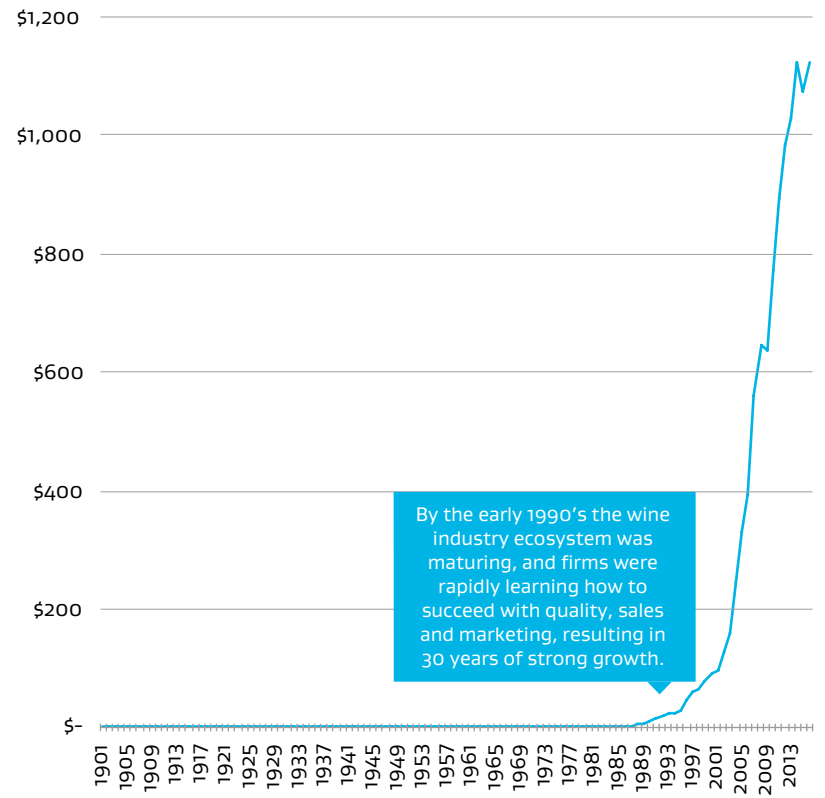
For 120 years New Zealand has developed world leading capabilities in the efficient production of commodities in response to strong market demand (e.g. the UK, more recently China) and the fact that commodities could be produced at scale from our natural resource base and could be transported long distances. The skill-sets and capabilities in the economy have developed in almost every respect to support this activity.

Historically, New Zealand's exporters have consisted of a few firms exporting large quantities of a few products.

Shifting into production of different value-added products, whether it is in food or high technology products, requires the development of new capabilities, within firms and in the economy as a whole.

The future is likely to be many firms exporting smaller quantities of a wide range of products to many markets. This poses challenges for policy makers and regulatory systems.

Example:
Total value of New Zealand wine exports: bottle (HS220421) & bulk (HS220429)
US$millions; 1901–2016



An ecosystem consistent with value-added and technology based industries has emerged in the last twenty years; many players have been involved

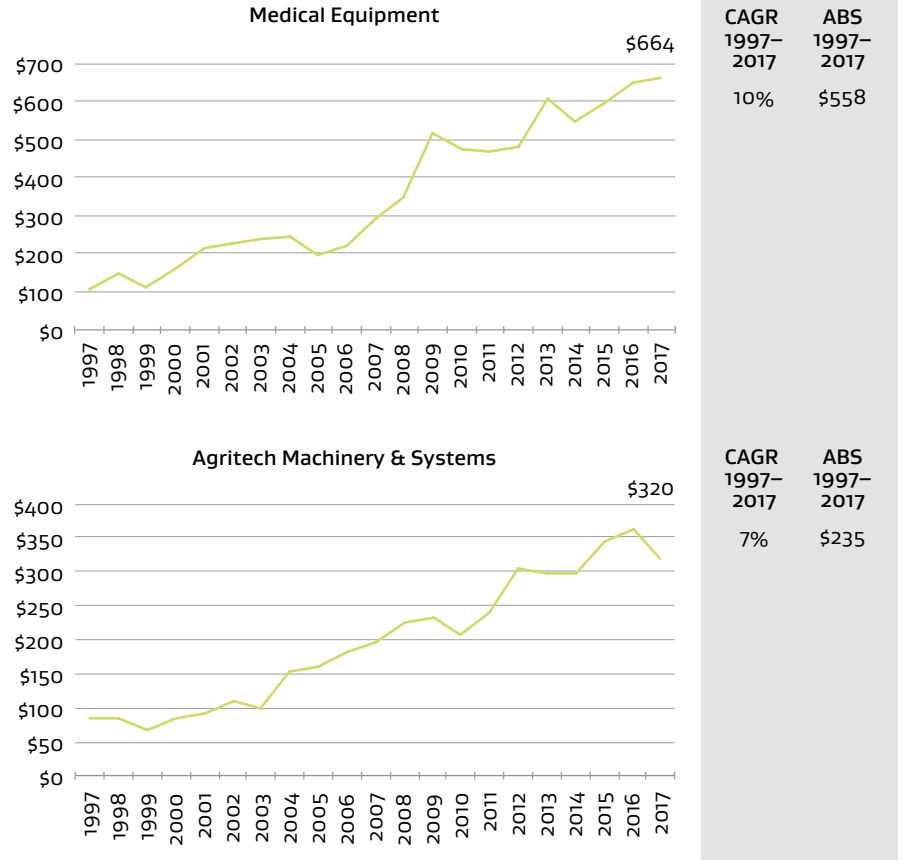
Selected support institutions in the New Zealand value-added and technology ecosystem

Source: TIN, MBIE (2017) The Investor's Guide to the New Zealand Technology Sector.

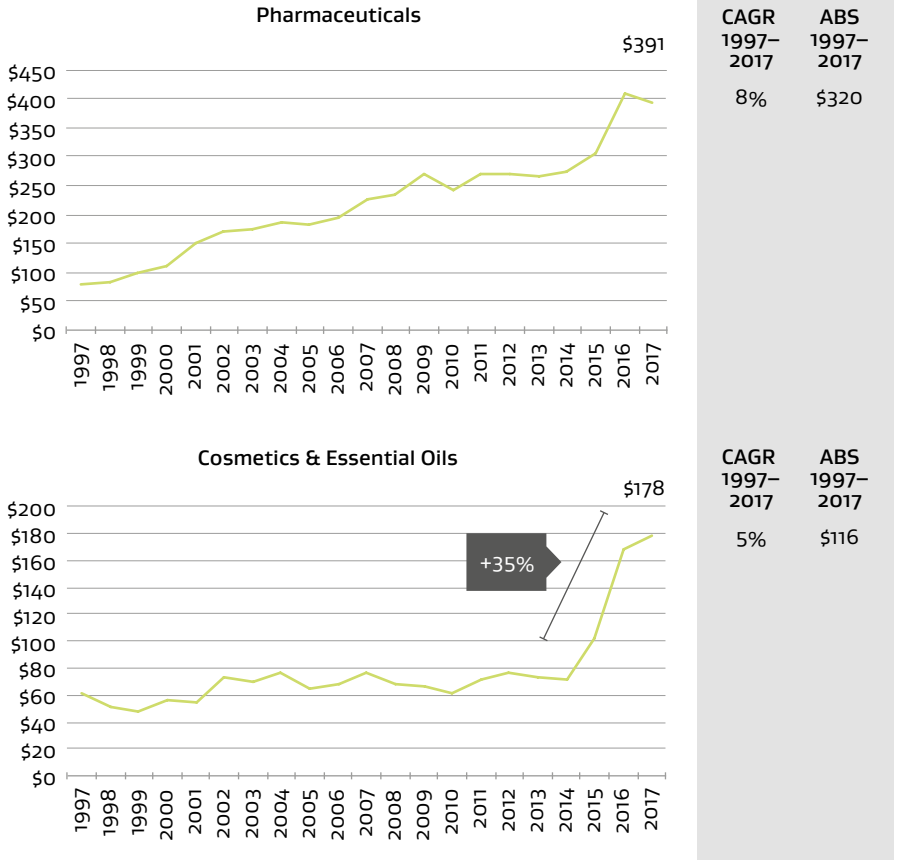
Twenty years of hard effort sees New Zealand exporters gaining traction in a wide range of high value categories, as these examples show

Manufactured exports, selected high value categories

NZ$ millions, year end June, 1997–2017



CAGR 1997–2017	ABS 1997–2017
10%	$558



CAGR 1997–2017	ABS 1997–2017
8%	$320

CAGR 1997–2017	ABS 1997–2017
7%	$235

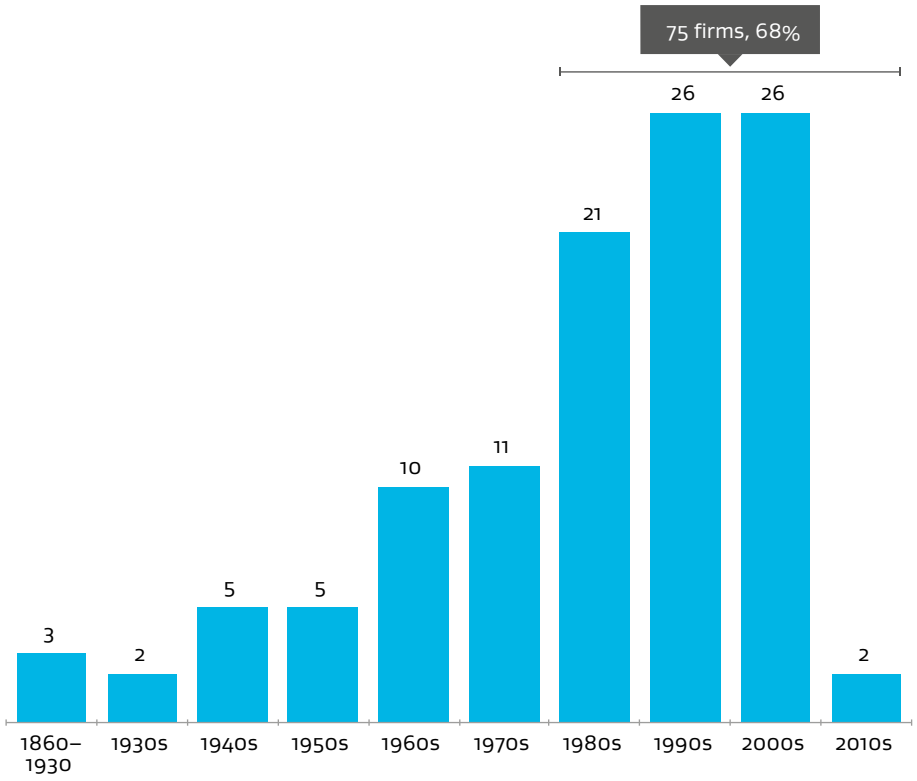
CAGR 1997–2017	ABS 1997–2017
5%	$116

Source: Exports data, Statistics New Zealand.

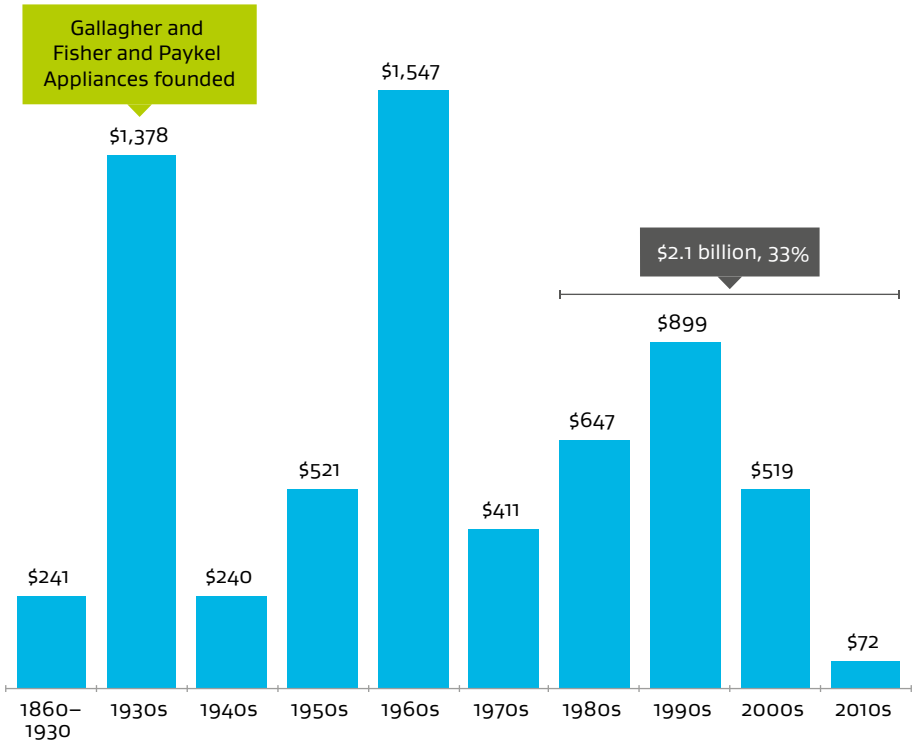
Growth is coming from a few long established firms and a large cohort of new firms

Of the 111 high and medium-high technology manufacturing firms profiled in the 2017 TIN report, 68% were founded in the 1980s or later, generating 33% of total 2017 revenues.

TIN 2017 manufacturing firms by decade founded
Firms, 2017



TIN 2017 manufacturing firm revenues by decade founded
NZ$ millions, 2017



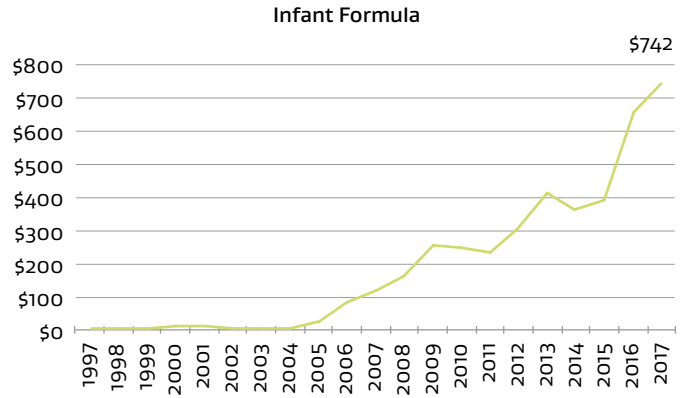
Notes: Figures include foreign owned New Zealand firms. Fisher and Paykel Healthcare was established as a separate firm in 2001, but Fisher and Paykel began developing health technologies in the late 1960s, so Fisher and Paykel Healthcare's formation and revenues are allocated to that decade.

Source: Technology Industry Network Ltd. (2017) TIN Report New Zealand 2017 (13th Edition). New Zealand: Technology Industry Network Ltd., MBIE Analysis. Used with permission.

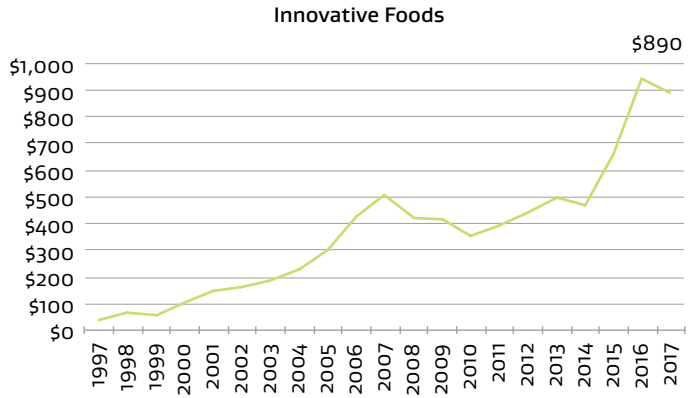
‘Food and beverage’ value-added/branded products are delivering strong growth, as these examples show

Manufactured exports, selected ‘food and beverage’ categories

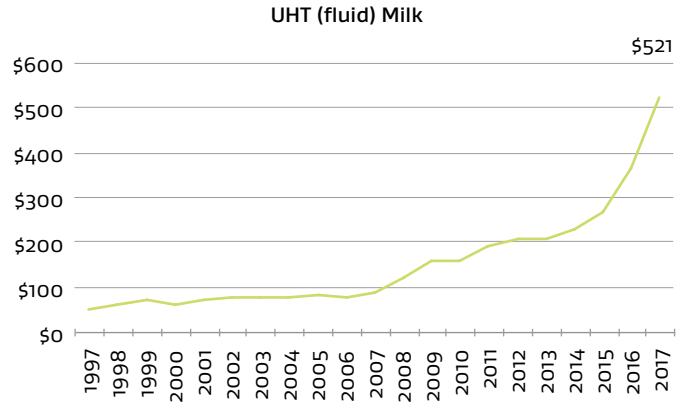
NZ$ millions, year end June, 1997–2017



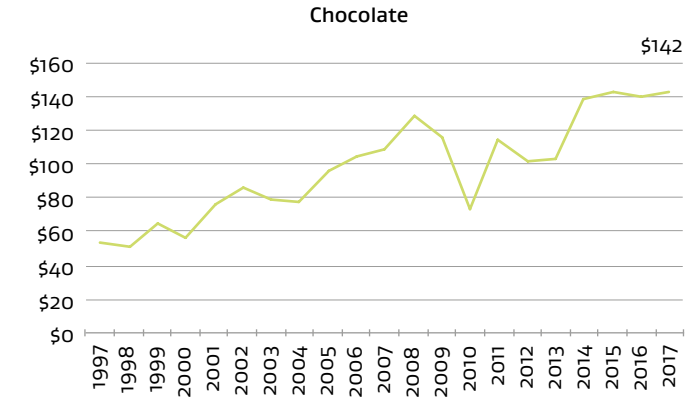
CAGR 1997–2017	ABS 1997–2017
27%	$736



CAGR 1997–2017	ABS 1997–2017
17%	$850



CAGR 1997–2017	ABS 1997–2017
12%	$470



CAGR 1997–2017	ABS 1997–2017
5%	$89

Note: ‘Innovative Foods’ is taken from trade code HS210690: other food preparations not elsewhere specified. This is a catch-all ‘category of categories’ for products that did not exist when the trade codes were developed. Past research shows that this category is almost exclusively a wide range of new, innovative food products ranging from self-saucing puddings to nutraceuticals.

New Zealand has high growth manufacturing firms operating in a wide range of industries

Selected manufacturing firms from the Deloitte Fast 50, 2016 & 2017

Firm	Industry	Description	Deloitte Fast 50
New Zealand Health Manufacturing	Food & beverage	Auckland based manufacturer of softgel, hardshell, tablet and powdered health products.	› Auckland Fastest Growing Manufacturing Business 2017
Ubco	Machinery & equipment	Tauranga based designer and manufacturer of an electric motorbike, specially designed for use on New Zealand farms.	› Hamilton Rising Star 2017
Pic's Peanut Butter	Food & beverage	Nelson based manufacturer of peanut butter focusing on a high quality product with no added preservatives, sugar or 'weird stuff'. Achieving strong market share against multi-national incumbents, e.g. Kraft.	› Wellington Fastest Growing Manufacturing Business 2017 › Founded 2007
MaxRaft	Other manufacturing	Queenstown based designer and installer of fully-insulated concrete foundation slabs. MaxRaft slabs are installed in residential buildings nationwide and help customers save money while reducing their carbon footprint.	› Ranked 16 on Deloitte Fast 50 2016 › Founded 2010
Switch Lighting	Other manufacturing	Nelson based manufacturer of LED lighting solutions.	› Deloitte Fast 50 Christchurch Fastest Growing Manufacturing Business 2017 › Founded 2009
Stronghold	Metals	Produces farm gates and animal management products.	› Deloitte Fast 50 Christchurch Fastest Growing Agribusiness 2017
Levno	Machinery & equipment	Palmerston North based producer of a fuel sensor, used to monitor fuel tank and milk vats levels. Alerts users when something out of the ordinary is happening, e.g. fuel theft. Also allows remote monitoring of temperature, volume and agitation of milk vats.	› Deloitte Fast 50 Wellington Rising Star 2017 › Founded 2011

Selected manufacturing firms from the Deloitte Fast 50, 2016 & 2017

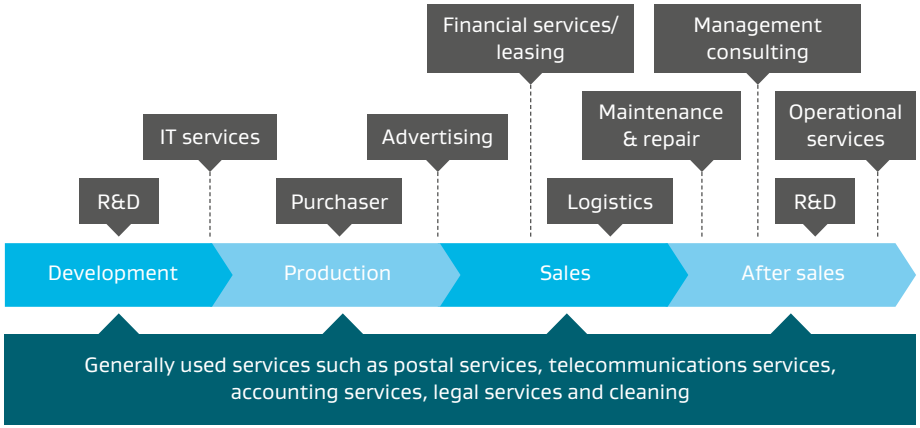
Firm	Industry	Description	Deloitte Fast 50
Grochem	Chemicals & refining	Porirua based producer of chemicals for the horticulture market. Uses a variety of technologies to offer a wide range of products in New Zealand, Australia and South Africa. Manufacturing in New Zealand for over 20 years.	› Deloitte Fast 50 Wellington Fastest Growing Agribusiness 2017
Panhead Custom Ales	Food & beverage	Launched in 2013 in Upper Hutt, Panhead Custom Ales are a craft beer brewery with a range of award-winning beers. Panhead experienced significant growth in 3 years before being bought by Lion Group.	› Ranked 4 on Deloitte Fast 50 2016 › Founded 2013 › Acquired by Lion Group
Blis Technologies	Chemicals & refining/ food & beverage	Dunedin based developers of oral probiotics. Produces strains of probiotic bacteria to assist in a variety of health issues, particularly with issues affecting the mouth and throat.	› Ranked 22 on Deloitte Fast 50 2016
Little Island Creamery	Food & beverage	Auckland based manufacturer of coconut milk based products. Little Island produce dairy-free alternative ice cream and flavoured coconut milk. Strong sales across Australasia.	› Ranked 27 on Deloitte Fast 50 2016 › Founded 2010
Kowtow Clothing	Other manufacturing	Designer and manufacturer of clothing made from 100% fair trade, organic cotton and manufactured in India with ethical working standards. Founded in Wellington.	› Ranked 30 on Deloitte Fast 50 2016 › Founded 2007
Ecoware	Plastics & rubber, wood & paper	Sustainable packaging company based in Auckland. Creates affordable packaging using bioplastic derived from plant resources as well as paper sourced from responsibly managed forests.	› Ranked 20 on Deloitte Fast 50 2016 › Founded 2011

NZ firms are finding success with highly niche products in multi-billion dollar global industries and with premium brands in commoditised categories

Firm	Industry	Description
Blunt umbrellas (premium brand in a commoditised category)	Other manufacturing	Described as a 'New Zealand owned tech company' Blunt umbrellas are 'the single most significant advancement in umbrellas in over a century'. Blunt is a textbook example of taking an everyday commoditised product and turning it into a premium brand. Blunt umbrellas sell for up to 10 times more than a standard umbrella.
Antipodes, Trilogy, Living Nature (gaining traction in a global industry)	Chemicals & refining	New Zealand has seen several local cosmetics companies emerge and carve out a niche in the highly competitive worldwide cosmetics industry. Companies such as Antipodes, Living Nature and Trilogy have all found success internationally with an emphasis on ethical, natural products and sustainability. The potential in this category for New Zealand is validated through the recent purchase of Trilogy by Chinese private equity firm Citic Capital China Partners for $250 million. The global cosmetics industry was valued at US$460 billion in 2014.
Pacific Helmets (niche)	Other manufacturing	Designer and manufacturer of safety helmets based in Whanganui. Founded in 1982, Pacific Helmets originally manufactured motorcycle helmets but now has a range catering to the needs of a wide group of industries and emergency services. Pacific Helmets now has around 80 staff and supplies 90% of the Australian emergency service helmet requirements.
Oceania Defence (niche)	Metals	Manufacturer of firearm suppressors based in Mount Maunganui. Oceania Defence uses 3D-printing technology to create one-piece suppressors from powdered titanium and Inconel.
Sanpro (very niche)	Machinery & equipment	Lower Hutt based manufacturer of tube perforating machines, used in the manufacturing of exhausts. All machines built are exported and Sanpro is the preferred supplier to the top five exhaust companies in the world.

Manufacturing firms are increasingly developing services to create competitive advantage

The 'servification of manufacturing' means the trend for manufacturing firms, particularly high technology manufacturing firms, to buy, produce, sell and export more and more services. Manufacturing and services are becoming closely interwoven at every stage of a manufacturer's operations.



Source: Swedish National Board of Trade 2010

Increasingly, the provision of services is where manufacturing firms add value to their product, both growing traditional sales and opening up new revenue streams.

> "[The] future of growth within manufacturing internationally is expected to come predominately from processes which involve combining advanced manufacturing with a range of different services, with services gradually becoming the way that firms pursue extra value-added."
>
> *Baigent 2016*

Servification is enabled to a large extent by software embedded in manufactured goods. Digitally enabled goods can be connected to the internet for ongoing or one-off services such as the diagnosis of faults or the collection and analysis of data. Services can also involve customised design, installation, maintenance and delivering on warranties.

The servification of manufacturing throughout all levels of operations is likely a significant factor in the statistical shift in value and employment from manufacturing to service sectors. For example:

- Service functions that were traditionally undertaken within a manufacturing firm (such as cleaning, accounting, transportation, catering, marketing, etc.) are now often outsourced to dedicated service provision firms.
- Automation of production, which requires significant use of IT and the maintenance of specialised industrial machinery and equipment, depends on increased levels of services around production (Baigent 2016).

> "[S]ervice functions (now increasingly outsourced) represent approximately 75% of the production costs of most manufacturing firms. . . these embedded services have largely gone unnoticed statistically."
>
> *Bryson and Daniels (2009) in Baigent*

> "Tait is growing its expertise in software and services to complement the design and manufacture of radio hardware we're famous for. Today, services makes up around 25% of revenue and Tait is focused on developing software solutions that integrate with its radio platforms to deliver added value to our clients."
>
> *www.taitradio.com*

Source: Baigent, D. (2016). Employment Clusters in Auckland: The Servitisation of Manufacturing, Adjustment Costs, and the Capturing of Complementary Economic Activity. University of Auckland.

Governments can play a role in the development and diversification of manufacturing industries

Examples of government policies to support growth and diversification in manufacturing

Discretionary roles*	Examples	Comment
Subsidise business expenditure on R&D	› Callaghan Innovation R&D Grants › Primary Growth Partnership programmes › R&D tax credits › Provision of access to technology, kit and expertise, e.g. sensing and automation, advanced materials in Callaghan Innovation; access to technical expertise and industrial scale pilot facilities in the New Zealand Food Innovation Network.	Nearly every government subsidises business R&D by some means, e.g. through targeted grants (such as the Small Business Innovation Research programme** in the US) or non-targeted tax credits (such as the UK R&D Tax Credit). The accepted rationale is that: profit-making firms invest less in R&D than is socially optimal, because they cannot capture all the benefits (the resulting knowledge "spills over" to other firms and the wider economy); and: the returns on any R&D investment are often highly uncertain.
Export facilitation & capability building	A variety of services provided by NZTE to assist companies to grow internationally and build business capability.	Most governments provide export assistance services, e.g. US Commercial Service; Austrade; Enterprise Ireland; International Enterprise Singapore.
Support for incubators/ accelerators	Incubators e.g. the Icehouse, and accelerators e.g. Sprout, partially funded by Callaghan Innovation.	Incubators and accelerators are a common solution internationally to assist start-ups and entrepreneurs to grow, build capability, develop technologies and products and access investment.
Foreign investment attraction	NZTE has a team of investment specialists to attract and assist foreign investment in New Zealand .	Foreign investment has played a key role in the development of New Zealand manufacturing, bringing skills, capabilities, access to distribution, most recently in driving growth of infant formula production and exports. Most developed countries have active government-led foreign investment attraction programmes.

* Note: "discretionary" means here that whether the government implements policies of this type, in what form and to what degree, is a matter of government policy.

** The US Small Business Innovation Research Programme defines a small business as one with up to 500 employees.

Governments also perform core functions that are a key part of manufacturing ecosystems; development of these to support the shift to value is ongoing

Examples of core government roles in manufacturing industry ecosystems

Core roles*	Examples	Comment
Regulation	Food safety, export certification, standards, health and safety, consumer law, labour market law, resource consent.	The quality of regulation and cost of compliance can impact on the competitiveness of an industry. Systems configured to support traditional industries may need augmenting to support the shift to value. A high quality regulatory environment can facilitate the adoption and diffusion of new technologies and the development of new industries, e.g. the space industry.
Skills provision	Quality primary and secondary education system. Tertiary degrees (e.g. engineering). Industry specific skills and qualifications, e.g. apprenticeships, Industry Training Organisations.	Lack of relevant skilled labour can constrain growth.
Infrastructure	Roads, rail, electricity, broadband, waste disposal, water reticulation.	Inefficient or insufficient infrastructure can impose costs.
Basic science	E.g. in materials, electronics, food structure, advanced manufacturing processes.	Basic/pre-commercial and blue-sky research is generally funded by governments, as the chance of a commercial payback is very small and the resulting knowledge may be difficult to appropriate privately.
Market access	FTAs, mutual recognition agreements, negotiating away non-tariff barriers.	Reduces the cost of exporting, opens up new market opportunities and new export categories.

* Note: "core" role here means that the government is the only institution in the economy that can fulfil this role, although in some instances the government may provide a core service on a fee-paying or cost-recovery basis, or contract the role to private sector players.

SECTION 10

Appendix

Glossary

Term	Definition
Closer Economic Relations (CER)	A free trade agreement between Australia and New Zealand, in effect since 1 January 1983.
Compound annual growth rate (CAGR)	CAGR is a measure of growth over time. It is the mean annual growth rate of an investment over a specified period of time longer than one year.
Employment	The number of people who earned money from employment (wages and salary earners) and/or self-employment.
Firm	The term 'firm' is used generically. It includes all relevant entities, which may be in the government, charity, education or health sectors.
Global Financial Crisis (GFC)	The Global Financial Crisis refers to the worldwide financial crisis beginning in 2007 that originated with the crisis in the US subprime mortgage market.
Goods exported	The value of goods of domestic origin exported from New Zealand to another country. Note: sector exports values will exclude items suppressed in accordance with Statistics NZ's confidentiality policy. Exclusions are noted where applicable.
Gross Domestic Product (GDP)	Gross domestic product (GDP) represents the country's income earned from production in New Zealand. It includes income from production carried out by New Zealanders and by foreign firms operating in New Zealand.
Labour productivity	Labour productivity is the most common measure of productivity. It measures the value of output produced per hour worked and is calculated by dividing the sector's real GDP by the number of hours of paid work.
Nominal GDP	Nominal GDP is the value of GDP expressed in dollars without adjusting for inflation.
Number of firms	The number of businesses or service entities operating in the sector in New Zealand. It covers all types of business or service entities, including companies, self-employed individuals, voluntary organisations and government departments.
Productivity	Productivity is a measure of how efficiently inputs are used within the economy to produce outputs.
Real GDP	Real GDP is GDP adjusted to remove the effect of price changes or inflation to show the change in the volume of goods and services produced. In this report it is expressed in constant 2010 prices.
Return on equity	Return on equity is calculated by dividing surplus before income tax, by shareholders' funds.

Acronyms

Term	Definition
ABS	Absolute value
ANZSIC	Australian and New Zealand Standard Industrial Classification
BERD	Business expenditure on research and development
CRI	Crown Research Institute
FTA	Free Trade Agreement
ITO	Industry training organisation
ITP	Institute of Technology and Polytechnics
LVL	Laminated veneer lumber
MDF	Medium density fibreboard
NZTE	New Zealand Trade and Enterprise
OECD	Organisation for Economic Cooperation and Development
PTE	Private training establishment
R&D	Research and development
SME	Small and medium enterprises
TIN	Technology Investment Network; the TIN report quantifies the economic significance of New Zealand's globally focused technology industry by capturing key data on the country's top 200 revenue earning, high-tech companies and reporting analysis on the 600+ companies surveyed each year.
UHT	Ultra-heat treated

Further reading

Previous reports in the Sector Reports Series are available from:
http://www.mbie.govt.nz/info-services/sectors-industries/sectors-reports-series/

For data on New Zealand's sectors see the New Zealand Sector's Dashboard:
http://www.mbie.govt.nz/info-services/business/business-growth-agenda/sectors-reports-series/new-zealand-sectors-dashboard

For analysis of New Zealand's productivity performance see The New Zealand Productivity Commission: https://www.productivity.govt.nz

For a detailed analysis of New Zealand's food and beverage industry see reports prepared by Coriolis Research as part of the Food and Beverage Information Project: www.foodandbeverage.govt.nz

For analysis of commodity and added value strategies in food and beverage manufacturing, see *Recommendations to the Food and Beverage Taskforce*, Coriolis Research, 2005. Available from www.coriolisresearch.com

For information on New Zealand's technology sectors see:

- NZ Technology Industry Association https://nztech.org.nz
- Technology Investment Network, publishers of the TIN reports https://tin100.com

For research and analysis on the development potential and forms of innovation in low and medium low technology industries see:

- Rama, R. (Ed.). (2008). *Handbook of Innovation in the Food and Drink Industry*. New York, NY: The Haworth Press.
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