

→ **FEATURED SECTOR**

High Technology Manufacturing





**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI

MBIE develops and delivers policy, services, advice and regulation to support economic growth and the prosperity and wellbeing of New Zealanders.

MBIE combines the former Ministries of Economic Development, Science + Innovation, and the Departments of Labour and Building and Housing.

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New Zealand Sectors Report 2013

The New Zealand Sectors Report comprises the Main Report and six additional, separate, reports providing an in-depth analysis of six individual sectors. The seven reports are:

1 The New Zealand Sectors Report 2013: Main Report

Featured Sector Reports

2 Information and communications technology (ICT)

**3 High technology manufacturing
(this report)**

4 Construction

5 Petroleum and minerals

6 Tourism

7 Knowledge intensive services



Minister's foreword

I am pleased to present this report on the growth of New Zealand's high technology and medium-high technology manufacturing sectors. As New Zealand's economy, exports and markets change and evolve, these sectors are an increasingly important part of our economy.

Innovation, be it in software, robotics, electronics, service offerings, business models or marketing, is the key driver of growth in the 21st Century. New Zealand has a remarkable number of innovative companies in the high and medium-high technology industries, carving out market share in tough international markets.

New Zealand is a small nation with a small domestic market, located some distance from the world's major supply chains, and that does bring its challenges. However, this report shows there is a lot to celebrate, with a strong cohort of established companies and an increasing number of ambitious start-ups successfully competing internationally from their New Zealand base.

The report confirms that the opening up of New Zealand's economy last century has had a fundamental effect on what we produce and what we sell to the world. We are seeing a number of emerging export sectors, such as information technology services (averaging growth of 11 per cent per annum since 2002), high-technology manufacturing and processed foods, line up and succeed alongside our more traditional commodity-based exports.

While both medium-high and high technology exports were affected by the Global Financial Crisis, both have shown resilience and demonstrated renewed growth since 2010.

Over the last two decades high technology manufacturing has grown rapidly, with exports rising from less than \$100 million a year in 1990 to \$1.4 billion in 2012. Exports of medium-high technology

goods are twice the size, at \$2.8 billion. Our top high technology manufacturers are global leaders because they generally specialise in niches. As the late Sir Paul Callaghan famously said: "New Zealand's brilliance is in the 'weird stuff' that the big players don't think to exploit".

The Government's Business Growth Agenda has set a target to increase exports to 40% of GDP by 2025. Within the BGA there are 58 separate initiatives that directly relate to the high and medium-high technology manufacturing sectors. These include establishing Callaghan Innovation to encourage greater business investment in research and development, lifting R&D co-funding dramatically (now up to \$142 million per year), and helping to better commercialise smart ideas into successful products.

This report is one in a series of seven giving detailed information about key sectors of our economy. One of the major themes coming through in these reports is how technology is changing every industry in New Zealand, at a pace and scale that is astonishing. This pace presents its challenges, but also creates exciting opportunities for our future.

Hon Steven Joyce

MINISTER FOR ECONOMIC DEVELOPMENT
MINISTER FOR SCIENCE AND INNOVATION
MINISTER FOR TERTIARY EDUCATION, SKILLS AND EMPLOYMENT
ASSOCIATE MINISTER OF FINANCE

Key terms and data limitations

Defining sectors

A sector is an area of economic activity in which businesses or other organisations (e.g. government or voluntary organisations) share a similar market or produce a similar product or service. Examples are retailing (businesses that sell products directly to consumers) and telecommunications (provision of communications services using wired or wireless infrastructure).

This report uses data grouped into sectors using the Australian and New Zealand Industrial Classification codes (ANZSIC codes). A business or other type of organisation is classified to an ANZSIC code based on its predominant activity. The term 'sector' is often used interchangeably with the term 'industry'.

Sources

The numbers in this report come from multiple sources. Data sourced from Statistics New Zealand is the latest that was available as at mid-December 2012. Some of this data is provisional and may change.

The data used covers different time periods for different metrics. For example, goods exports is for the year ended June 2012, while labour productivity is for the year ended March 2010.

Customised data for high and medium-high technology manufacturing

High and medium-high technology manufacturing are cross-cutting sectors combining several ANZSIC codes. Customised data has been provided by Statistics New Zealand for this report.

Export data

Some export data for cross-cutting sectors uses international sources in order to provide a longer time series. These sources may not

agree with Statistics New Zealand data due to differences in the group of exported products being allocated to the relevant sector.

Use of the term 'firm'

The term 'firm' is used generically. It includes all relevant entities, some of which are not firms at all, such as those in the charities, government, education and health sectors.

Example firms

This report provides examples of firms which are believed to belong to the sector. The example firms provide a partial answer to a key question on the composition of a sector: which firms are in it?

Firms are classified by Statistics New Zealand as being part of an industry sector according to their predominant activity. This is explained fully on the Statistics New Zealand website. The classification of each firm to a sector using the Australian and New Zealand Standard Industrial Classification (ANZSIC) system is **confidential** to Statistics New Zealand.

Because of the confidentiality rules, MBIE has used other publicly available sources to determine which firms are likely to belong to a sector. These sources may be inaccurate or incomplete.

Quotes and interviews

A limited number of interviews with sector leaders were carried out in the preparation of this report. Anonymous quotes from these interviews that illustrate key themes have been included. The opinions expressed are those of the industry participants. Additional quotes from public sources have also been used.

A full explanation of the data sources and limitations is provided in the Appendix.

Report objective

The New Zealand Sectors Report Series is a set of seven publications that provides a factual source of information in an accessible format on the key sectors that make up the New Zealand economy.

New Zealand needs to encourage all industry sectors to operate at their peak potential to meet the goals of our Business Growth Agenda. This report provides information on New Zealand's high and medium-high technology manufacturing sectors.

The report does not intend to draw policy conclusions. Its aim is to provide a comprehensive report card on the state of New Zealand's high and medium-high technology manufacturing sectors for business people, exporters, policy makers, media commentators, economists, academics, students and anyone with an interest in New Zealand's economic development.

The Ministry of Business, Innovation & Employment (MBIE) welcomes comment and feedback on this report, and on the measures the Government is taking to facilitate the development of competitive and successful technology manufacturing sectors. Email sectors.reports@mbie.govt.nz

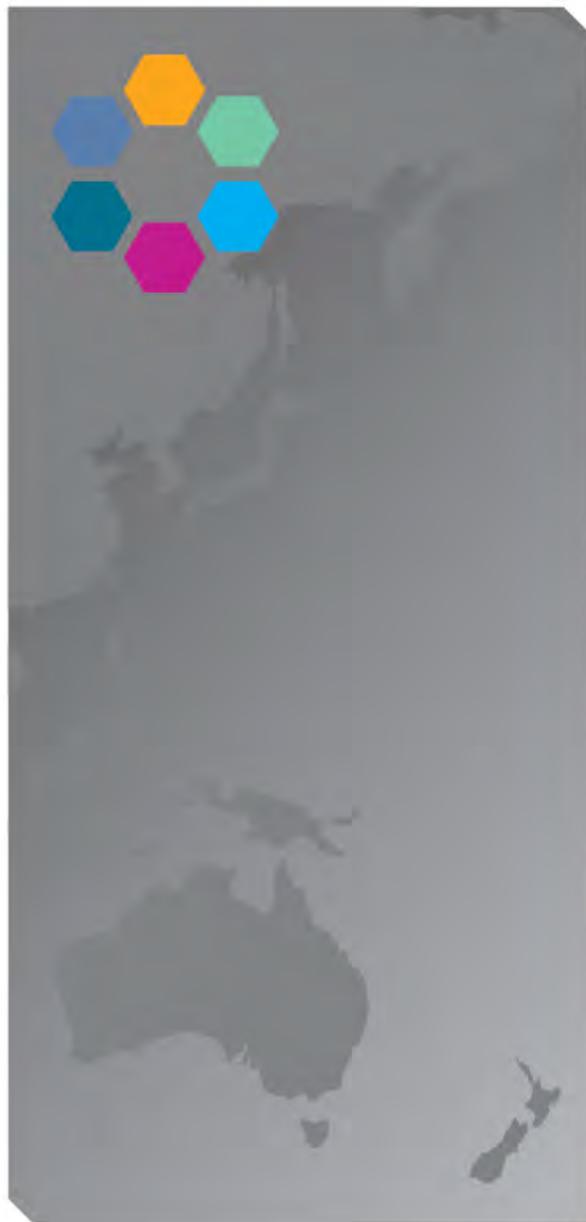


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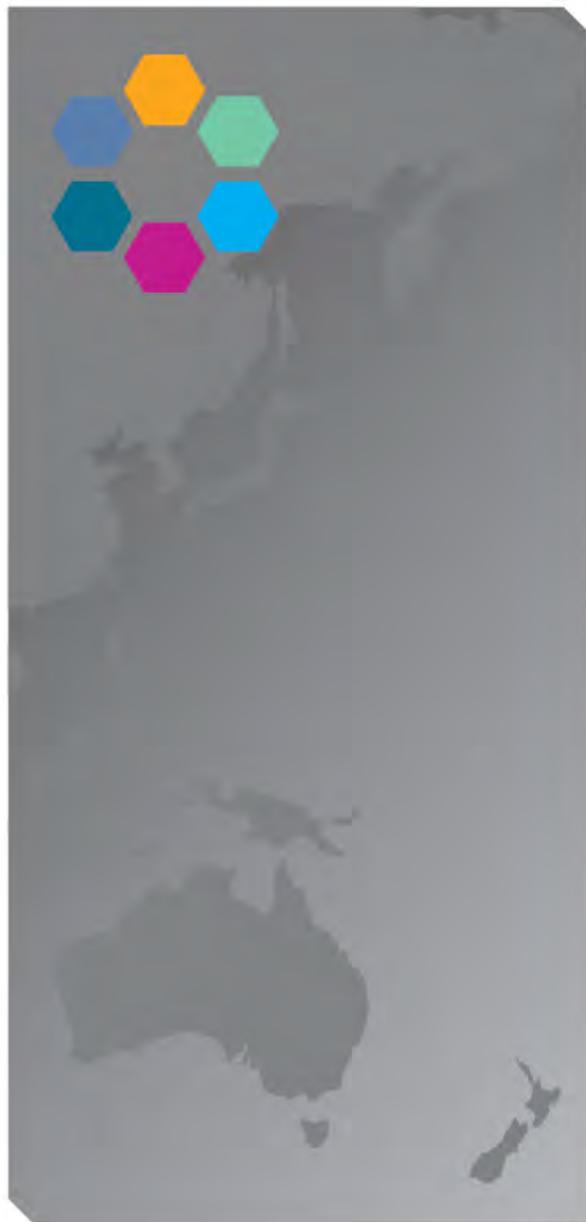


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Executive summary: high technology manufacturing

General

- High technology manufacturing is a sub-set of manufacturing industries in which expenditure on research and development is greater than 8% of revenues when measured across multiple developed countries combined. Industries which fit this criteria internationally are pharmaceuticals, aircraft manufacturing, professional and scientific equipment manufacturing (including medical technologies) and computer and electronic manufacturing (also classified as part of the ICT sector).
- This report finds that high technology manufacturing is a small component of all developed countries. New Zealand's sector is smaller than most, generating 0.7% of GDP in 2010 and employing 0.6% of the workforce. The sector is nevertheless the most export intensive in the economy and generates 3% of total exports.

Business and employment

- Employment grew rapidly until 2006, driven by medical & surgical equipment manufacturers. It has plateaued at around the 11,000 mark from 2006 onwards*, but grew by 1.1% last year.
- The sector has 23 firms that employ more than 100 people. Together these firms employ 6,450 workers, or 45% of the sector's total workforce.
- A small number of large firms generate the majority of exports, as is common in other small developed economies.
- Auckland accounts for 54% of the sector's workforce, with a quarter located in Christchurch. Hamilton is the next largest at 3%.
- Workers in high technology manufacturing are paid over a third more than the New Zealand average, although wage growth has slowed recently.

Expansion and R&D

- In 2012, 44% of firms in the sector invested in expansion, compared to 31% for manufacturing firms as a whole. 45% of firms invested in R&D, spending \$1.3 million per year on average, almost four times the New Zealand average, making the sector the most R&D intensive in the economy.

Exports

- High technology manufacturing has developed from small beginnings in the early 1990s to become a significant export earner, with \$1.4b in exports in 2012 – higher than wine exports, whose growth began about the same time. Post 2006 data indicates that the sector struggled with both the rising exchange rate and the Global Financial Crisis. Exports saw a significant recovery in 2011, growing at 6.6%. Almost one third of all high technology manufacturing firms derive 75% or more of their sales from exports.
- Fisher & Paykel Healthcare, Rakon and New Zealand's pharmaceutical industry delivered the sector's three leading export goods in 2012.
- The US and Australia together account for 45% of exports. However, the sector also supplies small quantities to a large number of markets globally, possibly reflecting the niche characteristics of the products.
- Larger firms are increasingly moving scale manufacturing to lower cost locations, often closer to market. This trend is similar to that in other developed countries. R&D on the other hand tends to be retained in New Zealand.
- Services are an increasingly important source of (ideally repeatable) revenues for high technology manufacturers.

**Excluding self-employed workers.*

Executive summary: medium-high technology manufacturing

General

- Medium-high technology manufacturing is a sub-set of all manufacturing industries in which expenditure on research and development is between 2% and 8% of revenues when measured across multiple developed countries combined. Industries that fit this criteria include the manufacture of polymers, chemicals (excluding pharmaceuticals), transport equipment and machinery and equipment.
- This report finds that the sector in New Zealand is twice the size of the high technology manufacturing sector, but is still a small component of GDP compared to peer group countries. It accounted for 1.4% of GDP in 2010 and employed 1.5% of the workforce, and generated 6% of exports in 2012. The size of New Zealand's high and medium-high technology manufacturing sectors in relation to each other is similar to other developed countries.

Business and employment

- The sector had a net-loss of 2,774 jobs from 2002-12, with 60% of these in the chemicals subsector. The high dollar and the GFC saw a sharp drop in employment in 2009-10, but employment grew in 2012 with 800 jobs added.
- The sector has 48 firms that employ more than 100 people. Together these employ 11,260 workers, or 35% of the sector's total workforce.
- Auckland is the major location with 34% of the workforce, followed by Christchurch with 15%. Compared to the high technology sector, medium-high technology manufacturing has a stronger presence in New Zealand's regions with Hamilton, Lower Hutt, Tauranga and New Plymouth together accounting for 16% of the sector's workforce.

- Workers in medium-high technology manufacturing are paid 16% above the NZ average, although wage and salary increases have been marginally below the total New Zealand average since 2006.

Expansion and R&D

- In 2012, 35% of firms in the sector invested in expansion, compared to 31% for manufacturing firms as a whole. 29% of firms invested in R&D, spending \$399,000 per year on average, marginally more than the NZ average, but significantly less than that for high technology manufacturing. Some individual firms spend significantly more than this.

Exports

- Exports of medium-high technology goods were worth NZ\$2.8b in 2012. Post 2006 data indicates the sector having struggled with both the rising exchange rate and the Global Financial Crisis. Volumes have grown strongly since 2009, and this is reflected in growing export value in US dollar terms. However, the high New Zealand dollar has meant that value growth has been flat to declining when viewed domestically. This value will increase as the New Zealand dollar starts to decline against the US dollar.
- Australia accounts for 48% of exports, with the US market second at 13% and East Asia growing in importance.
- The sector can be characterised as an Australasian industry, with New Zealand and Australia combined generating around 90% of total revenues.
- The sector's leading exports reflect the significance of New Zealand's agricultural industries, e.g. harvesting and agricultural machinery, along with other strengths such as Fisher and Paykel Appliances' whiteware and Buckley Systems' electro-magnets.

Executive summary: comparing the two sectors

High technology manufacturing is the smaller sector, but exhibits greater innovation, export intensity and productivity, and higher revenue growth

General

- High and medium-high technology manufacturing together comprise 22% of economically significant manufacturing firms (>5 employees), 17% of manufacturing GDP, and 12% of manufacturing goods exports.
- As in other developed countries, the high technology sector is the smaller of the two, generating half the GDP of the medium-high technology sector (\$1,181m versus \$2,426m), exporting goods worth half as much (\$1.4b versus \$2.8b), and employing less than half the number of workers (14,200 versus 33,100).*

Business and employment

- At the same time as employment was growing rapidly in high technology manufacturing (in the 5 years to 2006), employment began falling in medium-high technology manufacturing. In both cases, the changes were driven by the larger firms in each sector (more than 50 employees).
- The number of medium-high technology manufacturers has declined since the GFC, while the number of high technology firms continued to increase. Nevertheless, the medium-high technology sector's overall size has meant that it still added the greater number of firms over the last decade (283 versus 191).

Exports

- The high technology manufacturing sector is the most export intensive sector of the economy, with 70% of firms reporting export sales that together generate 29% of the sector's revenues. In contrast, about the same proportion of medium-high technology manufacturing firms report export sales as for all manufacturing firms (50%), together generating 18% of the sector's revenue.

- Over the last decade, nominal export values in NZ dollar terms have hardly risen for medium-high technology manufacturing because of the rise of the NZ dollar over the period from 2004 to 2013 (with a brief significant drop in 2009). The high technology sector's exports now generate 30% more in export value than a decade ago.
- Although the key export markets are very similar for each sector, medium-high technology exports are much more concentrated in Australia (48%) than those of high technology manufacturing (24%); and, when measured in US dollar terms, annual growth in exports to the US has been much lower for medium-high technology manufacturing (1%) than for high technology manufacturing (10%).

Expansion and R&D

- The high technology sector reports significantly higher rates of innovation (73% of firms) than does the medium-high technology sector (55%), whose innovation rate has been declining (down from 62% in 2007). Similarly, more high technology firms report product innovations (53% versus 40%), of which a higher proportion are new to the world (44% versus 38%), although medium-high technology firms still out-perform other manufacturers generally.

Productivity and financial performance

- High technology manufacturers add greater value than medium-high technology firms (35% of sales revenue versus 29%), are more productive, and generate a higher return on equity (19% versus 16%).
- However, the medium-high technology manufacturing sector generates greater income and, at times, a higher surplus, per employee, than does high technology manufacturing.



DEFINITION AND KEY THEMES

What are the high and medium-high technology manufacturing sectors?

High and medium-high technology firms are defined by their level of expenditure on R&D

Focus of this report

- This report is focused on New Zealand's high and medium-high technology manufacturing sectors, as defined by the OECD.*
- Rather than aggregate the data for both sectors, the charts provide data which compare the performance of New Zealand's high technology manufacturing sector with that of the medium-high technology manufacturing sector.
- MBIE considers that the high and medium-high technology manufacturing sectors together account for two thirds of the most innovative manufacturing firms in New Zealand, outside of food & beverage manufacturing.

High technology manufacturing

- High technology manufacturing is a narrow sub-set of manufacturing industries in which expenditure on research and development is greater than 8% of revenues, based on combined data from 25 developed countries.
- It includes pharmaceuticals, aircraft manufacturing, professional and scientific equipment manufacturing (including medical technologies), and computer and electronic manufacturing. In New Zealand these industries spend between 0.9% (pharmaceuticals) and 6.9% (professional and scientific equipment) on R&D as a percentage of revenues.
- This definition is a considerably tighter definition than is commonly meant when reference is made to New Zealand's 'high tech' sector, for example, in the annual TIN 100 publication or at the annual High Tech Awards.

Medium-high technology manufacturing

- Many of the manufacturing firms in New Zealand commonly thought of as 'high tech' firms are in fact in industries which are formally classified as medium-high technology manufacturing.
- Medium-high technology industries are those industries in which expenditure on R&D is between 2% and 8% of revenues, based on combined data from 25 developed countries.
- Industries captured include the manufacture of polymers, chemicals (excluding pharmaceuticals), transport equipment, and machinery and equipment. In New Zealand these industries spend between 0.3% (chemicals) and 2.3% (transport equipment) of revenues on R&D.
- These R&D figures are aggregates. Individual firms may spend significantly more or less on R&D.

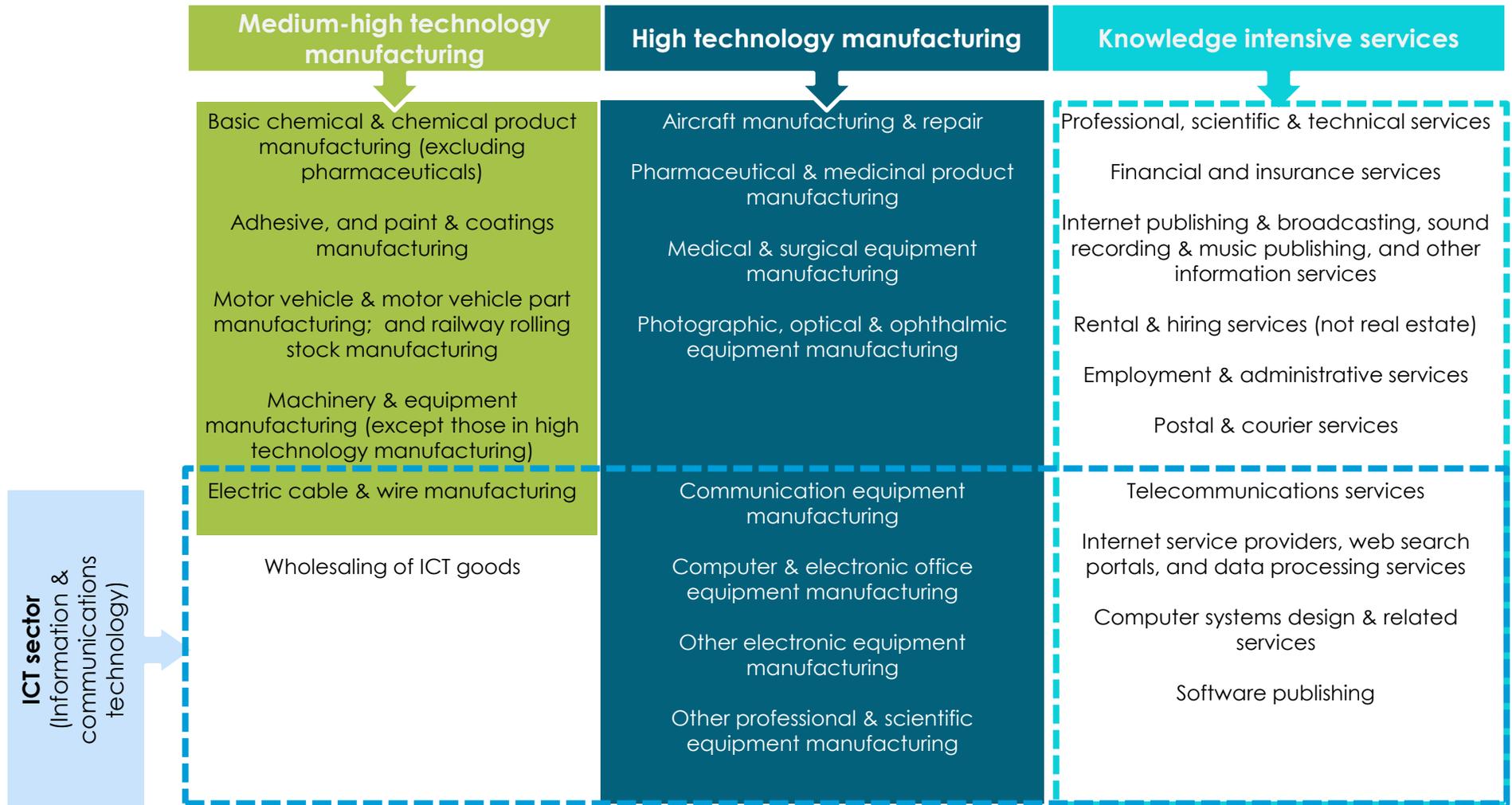
It is very important to keep the industry dimension in perspective. High tech industries ...make up only a small component of manufacturing, and an even smaller component of GDP. This is true of all OECD economies. ...All OECD economies rest on a combination of large medium-technology and low-technology manufacturing industries, such as food and beverages, or fabricated metal products, and large-scale service activities, of which the largest are education, and health and social services.

Keith Smith, *Public Policy Framework for the New Zealand Innovation System*, Ministry of Economic Development, Occasional Paper 06/06 (May 2006)

*See the Appendix for a more detailed definition, including the relevant ANZSIC codes.

High level definitions: high and medium-high technology manufacturing*

High technology manufacturing includes manufacturing industries that are also classified as part of the ICT sector



*The full definition of the high and medium-high technology manufacturing sectors is provided in the Appendix

Examples of high technology manufacturing firms

The sector produces a wide range of products, many highly specialised

Brief profile of significant firms in the New Zealand high technology manufacturing sector

2012, or as available

Firm	Revenue	Employees	Ownership	Description / products
Fisher & Paykel Healthcare	\$517m	2,600	Listed; NZ (NZX: FPH)	Designs and manufactures products and systems for use in respiratory care, acute care, and the treatment of obstructive sleep apnea.
Tait Communications	~\$200m	930	Private; NZ (charitable trusts)	Delivers and manages communications solutions that support the operations of utilities and public safety organisations.
Rakon	\$178m	2,300	Listed; NZ (NZX: RAX)	Develops and manufactures high performance quartz crystal components used for timing reference and frequency control in demanding applications, such as global positioning systems and wireless communications.
Gallagher	\$187m	760	Private; NZ (Gallagher family)	Designs and manufactures products and services for perimeter security, the weighing and electronic identification of farm animals, electric fences on farms, fuel dispensing systems, and undertakes contract manufacturing.
Douglas Pharmaceuticals	\$127m (est)	475	Private	Develops and manufactures generic pharmaceuticals.
Dynamic Controls	\$92m (est)	391	Foreign	Design and manufacture of power wheelchair and mobility scooter controls.
AuCom Electronics	\$45m (est)	120	Private	Designs and manufactures reduced voltage motor starters, motor control centres, and medium voltage switchgear.
MagriTek	\$6.5m	40	Private	Nuclear magnetic resonance technology.

Examples of medium-high technology manufacturing firms

The sector produces a wide range of products, some highly specialised and others which aim to have an edge in highly competitive categories

Brief profile of significant firms in the New Zealand medium-high technology manufacturing sector

2012, or as available

Firm	Revenue	Employees	Ownership	Description / products
Fisher & Paykel Appliances	\$1b	3050	Foreign (Haier Group)	Cooking products, refrigerators, dishwashers, washing machines, direct drive motors, production machinery.
Moffat	\$153m	352	Foreign	Manufacturer of commercial foodservice and baking equipment.
Skope Industries	\$105m	406	Private	Commercial refrigeration and foodservice refrigeration equipment.
Glidepath	\$75m	200	Private	Airport baggage handling and security systems.
Buckley Systems	\$70m	270	Private	Manufacturer of precision electromagnets.
Compac Sorting Equipment	\$83m	310	Private	Sorting and packing machines, robotics and automation, and traceability software.
Scott Technology	\$54m	225	Listed, NZ (NZX: SCT)	Appliance manufacturing systems, meat processing automation, sample preparation equipment for the mining and minerals sector, and high temperature superconductor magnets.
Wellington Drive Technologies	\$35m	60	Listed, NZ (NZX: WDT)	Energy efficient electric motors and motor controls.
Zelam	\$15m	60	Private	Chemical company providing products for niche domestic and international agrichemical and timber markets.

Key themes

A number of key themes emerged from the high and medium-high technology manufacturing sectors

Theme	Description	Details																				
Manufacturers becoming service providers	Manufacturers are developing business models that integrate service offerings with goods to create competitive advantage, e.g. training, design, customisation, software.	<ul style="list-style-type: none"> • Communication equipment manufacturer, Tait Communications, reports that services now account for a quarter of its revenue, up from only 5% a few years ago. • Framacad operate an integrated service and manufacturing model. • <i>Services such as training and maintenance are a growing complement to equipment and machinery exports.</i> <p>– McKinsey Global Institute, <i>Manufacturing the Future</i>, 2012</p>																				
Internationally connected	<p>The high technology sector has high rates of foreign ownership, balanced by high rates of off-shore investment by New Zealand-owned firms in sales and marketing offices, servicing and support, and manufacturing facilities. A high proportion of firms in the sector are exporting.</p> <p>The medium-high technology sector is more internationally connected than manufacturing generally, but less than the high technology sector.</p>	<table border="1"> <thead> <tr> <th>Metric</th> <th>High technology</th> <th>Medium-high technology</th> <th>All Manufacturing</th> </tr> </thead> <tbody> <tr> <td>Percentage of firms with at least some foreign ownership</td> <td>22%</td> <td>12%</td> <td>9%</td> </tr> <tr> <td>Percentage of firms with off-shore assets</td> <td>17%</td> <td>12%</td> <td>7%</td> </tr> <tr> <td>Percentage of firms that export</td> <td>70%</td> <td>50%</td> <td>50%</td> </tr> <tr> <td>Percentage of firms generating >75% of revenues from exports</td> <td>31%</td> <td>7%</td> <td>7%</td> </tr> </tbody> </table>	Metric	High technology	Medium-high technology	All Manufacturing	Percentage of firms with at least some foreign ownership	22%	12%	9%	Percentage of firms with off-shore assets	17%	12%	7%	Percentage of firms that export	70%	50%	50%	Percentage of firms generating >75% of revenues from exports	31%	7%	7%
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Manufacturing going digital	New technologies are changing the structure and competitiveness of manufacturing.	<ul style="list-style-type: none"> • Digital modelling, simulation and visualisation; advances in industrial robotics; additive manufacturing (e.g. 3D printing); and information technology trends, such as big data, advanced analytics and social technologies are all changing the face of manufacturing. 																				
Niche markets / capital goods	Many firms in these sectors focus on competing in narrow market segments. Customers tend to be other businesses or industries, such as in healthcare. Consumer products are just a quarter of total exports.	<ul style="list-style-type: none"> • Rakon has a 50% share of the world market for the piezoelectric crystals that are used in global positioning systems. F&P Healthcare is responsible for over 5% of world exports in therapeutic respiration apparatus. • NZ does not make smartphones – NZ makes the crystal oscillators inside the smartphones. • <i>Our brilliance has been in the 'weird stuff' that the big players don't think to exploit.</i> <p>– Sir Paul Callaghan</p>																				

Key themes

A number of key themes emerged from the high and medium-high technology manufacturing sectors

Theme	Description	Details
Research & development advantage	There is a widespread perception that New Zealand has some cost and culture advantages in research and development.	<ul style="list-style-type: none"> Exports of R&D services in 2012: \$151m. These grew at a compound annual growth rate of 5% from 2007-2012. The US takes 46% of the total and Australia 36%. <i>We have a huge advantage to the rest of the world, in that our people often span silos. In the rest of the world you get real silo expertise, but oftentimes the best innovation comes from applying something done in one silo to another</i> – CEO, small medium-high technology firm.
Exchange rate / GFC	The impact of the GFC and the appreciating New Zealand dollar are clearly evident in the data.	<ul style="list-style-type: none"> <i>Quite a bit of the flattening out of export growth in the last four years or so might not be because of underlying volume growth flattening out. The rising New Zealand dollar ...means that if you are selling 10% more every year you may have seen no growth in New Zealand dollar revenue terms.</i> – CEO, large high technology firm. The high technology sector appears more resilient, while the medium-high technology sector appears more sensitive to exchange rate fluctuations. Possible reasons for greater sensitivity could be a higher labour content and/or more international competition in medium-high technology products (e.g. whiteware, agritech).
Australia matters	The Australian market is critical to New Zealand's high and medium-high technology manufacturing sectors.	<ul style="list-style-type: none"> Australia takes 34% of New Zealand high technology exports. Australia takes 48% of New Zealand's medium-high technology exports. New Zealand and Australia combined generate 90% of revenues for New Zealand's medium-high technology sector.
Developing ecosystem	In the last 12 years the supporting ecosystem for technology sectors has developed in complexity and depth from a low base, providing a platform for future growth.	<ul style="list-style-type: none"> Components of the ecosystem include venture and angel capital, incubators, innovation parks / hubs, awards and competitions, NZTE programmes, increasing numbers of serial entrepreneurs, lawyers and accountants specialising in technology, university owned commercialisation and innovation companies, spinouts from existing firms, start-ups based on university or CRI intellectual property, and some large exporting firms.
Manufacturing off-shore	New Zealand is seen as efficient for R&D and product development, short manufacturing runs, or manufacturing of very high value products. Scale manufacturing is moving to lower cost countries, close to markets.	<ul style="list-style-type: none"> <i>We plan, if at all possible, to keep roughly the same level of manufacturing in New Zealand over the next decade, but to orientate it more and more to new products that are close to R&D. When the volumes rise, beyond the first production line if you like, [we plan] then to put subsequent growth into a lower cost location. [Then]... you have the benefit of new processes and products being close to R&D, but then the benefits of the higher volumes being made in the lower cost environment.</i> – CEO, large high technology firm.

Characteristics of high technology manufacturing firms

The following characteristics are typical of high technology manufacturing firms; most also apply to medium-high technology firms

Characteristic	Details
Engineering and science based	<p>High technology manufacturing is an engineering and science led activity. Highly qualified scientists, engineers and designers are involved in the creation of intellectual property (products and processes), whilst the establishment and operation of manufacturing facilities generally requires significant involvement from highly skilled engineers.</p>
Capital intensive	<p>Large scale high technology manufacturing is a capital intensive activity, requiring significant investment in facilities and equipment. The capital expenditure requirements can be less for smaller scale manufacturing (e.g. small runs of products for niche markets), but are still likely to be significantly higher than in related sectors (e.g. software development).</p> <p>Start-up firms typically require significant investment in R&D over a sustained period to prove the quality of their intellectual property, and then further significant investment to get that intellectual property to market. In total, an average of \$25m of investment is usually required.</p>
High growth / high cost	<p>High growth firms require significant capital to fund sales, marketing and customer support (training, help desk and maintenance services). These demands may postpone profitability for a significant length of time. Substantial outside funding is therefore likely to be required to fund this growth (cf. companies like F&P Healthcare that grew organically over a long period of time, initially with support from a large existing business).</p>
R&D intensive / high innovation rate	<p>Statistics NZ reports that 45% of high technology firms undertake R&D, with expenditure averaging \$1.3m per firm. Typically, high technology firms have a relatively high share of new products and technologies in the total volume of their production or service offering.</p> <p>In comparison, 29% of medium-high technology firms undertook R&D in 2012, still 10% above the New Zealand manufacturing average.</p>

Characteristics of high technology manufacturing firms *continued*

Characteristic	Details
Regulatory barriers / cost of compliance	Complying with multiple standards in different export countries can be a significant cost. Obtaining approval from regulatory authorities (e.g. the US Food & Drug Administration for medical devices) can be time consuming, as well as costly. Firms experience difficulties hiring New Zealand-based experts in this field.
Software	Most high technology products and many medium-high technology products will contain software components, at the least as software embedded in the device or product (a chip needs some code for it to do anything). As manufacturing (the making of things) becomes more commoditised, firms are increasingly developing sophisticated software components to provide a competitive advantage and additional (ideally recurring) revenue streams.
Close to market	The sophistication and often highly customised nature of the products, plus an increasing service component, means that high technology firms generally need to establish sales, marketing and support offices in key markets. A pattern is that core R&D capabilities are maintained and expanded in New Zealand, possibly along with core manufacturing capabilities. As the firm grows scale manufacturing is often moved to lower cost locations, which are often also closer to customers.



THE GOVERNMENT'S BUSINESS GROWTH AGENDA



The Government's Business Growth Agenda

Actions to support innovation in the high and medium-high technology manufacturing sectors

Encouraging business innovation

- The establishment of Callaghan Innovation to encourage business innovation in high-value manufacturing.
- Increase business R&D co-funding by 21%, from \$117m per annum to \$142m per annum.
- Implement new approaches to business R&D grants to encourage business innovation including:
 - R&D Growth Grants: Targeting businesses with a strong track record for R&D spending in New Zealand, this is a three-year grant programme with a \$5m cap on funding per annum.
 - R&D Project Grants: Targeting firms with smaller R&D programmes and those that are new to R&D, typically providing 30-50% public co-funding.
 - R&D Student Grants: Providing support for undergraduate and postgraduate students to work within R&D active business.
- Increase the proportion of total public innovation investment dedicated to firm-led innovation.
- Identify and implement improvements to incubator settings, including examining international models.
- Maximise the competitiveness of the New Zealand business environment to encourage innovation.
- Investigate whether tax treatment of R&D is discouraging firm R&D.
- Simplify and modernise government procurement policy to encourage innovation and firm participation.
- Continue to increase annual public science and innovation funding towards 0.8% of GDP as fiscal conditions allow.

Developing innovation infrastructure

- Roll-out Ultra-Fast Broadband through fibre to 75% of New Zealanders by end of 2019. Ultra-Fast Broadband will enable exporters to competitively deliver services offshore.
- Investigate and encourage the development of Innovation Parks.

Improving intellectual property settings

- Complete passage of the Patents Bill to more closely align New Zealand's patent settings with trading partners.
- Create a single trans-Tasman patents examination regime with Australia to simplify patent applications.
- Investigate whether the intellectual property settings of public institutions are optimal for technology transfer.
- Explore opportunities for government to improve the environment for firms' use of intellectual property.



The Government's Business Growth Agenda

Actions to improve availability of skills

Growing the innovation workforce

- Increase investment in engineering studies at tertiary institutions and lift graduate numbers by 500 per annum by 2017.
- Collect and provide better information on career prospects to students and the tertiary sector.
- Highlight the role of entrepreneurship in business innovation through annual Prime Minister's Business Scholarships.
- Investigate highlighting innovation careers in science, design, engineering and maths to school students and their families.
- Establish annual Prime Minister's Science Prizes to acknowledge and reward scientific achievement.
- Maintain internationally competitive personal tax rates that encourage highly-skilled workers to work from New Zealand.

Delivering vocational education

- Develop dedicated Maori and Pasifika trades training initiatives to increase their participation and improve their progression and earnings potential.
- Complete targeted review of qualifications at levels 1 to 6 to reduce the number of qualifications and simplify pathways for trainees and employers.
- Introduce clear vocational pathways for senior secondary school students and foundation learners, to provide clear options for those seeking vocational careers.
- Introduce NZ apprenticeships and the apprenticeship reboot to ensure a durable system that lifts performance qualification levels for all trainees.
- Lift the number of Youth Guarantee places to support 16 and 17 year olds staying in education longer.

Strengthening tertiary education

- Purchase additional tertiary places as required to meet demand across the sector, including in engineering.
- Complete the introduction of performance-linked funding to focus providers on achieving results for students.
- Publish employment outcome information and likely industry demand indicators, to better inform prospective students about study choices.

Attracting skilled migrants and investors

- Review investor, entrepreneur and worker policy settings with a view to attracting migrants with the right skills and capital to invest.
- Introduce Silver Fern Visa to provide employers with greater access to young skilled migrants.
- Implement Immigration Global Management System upgrade and network configuration.
- Review the Essential Skills in Demand lists, to examine their effectiveness in addressing skills shortages in the short- and long-term.



The Government's Business Growth Agenda

Actions to support exporters and businesses looking to expand internationally

Strengthening high-value manufacturing and services exports

- With Callaghan Innovation, and through New Zealand Trade and Enterprise (NZTE) programmes Better by Design, Better by Lean, Better by Strategy and through the Primary Growth Partnership, assist firms to grow international capability.

Making it easier to trade from New Zealand

- Establish a single trade window for importers and exporters.
- Enhance the NZ Export Credit Office products and services, improving guarantee products to support export growth.
- Undertake 28 Minister-led trade missions over the parliamentary terms to unlock strategic opportunities for business.

Helping businesses internationalise

- Deliver targeted services to approximately 2000 internationalising firms, with an intensive focus on 500 firms. Of the current 500, 125 are manufacturing firms. Examples of services include Beachheads, Path to Market and Capital.
- Deliver multi-firm, high impact market development programmes to accelerate the success of firms in the Aviation, Marine, Agribusiness and Medical Technology sectors.
- Use the International Growth Fund (IGF) to assist high growth firms to internationalise.
- Better by Capital has been re-launched as a service to assist high growth firms to plan for and attract the growth capital required to achieve their international growth plans.
- Deliver integrated knowledge on key markets to business from all agencies operating off-shore.
- Develop with key stakeholders a broad, compelling, and flexible New Zealand story that works for a range of exporters and sectors, including tourism and education, and for immigration.



The Government's Business Growth Agenda

Actions to improve investment and access to capital

Strengthening equity markets

- Partially-list four State-owned enterprises on the NZX exchange.
- Investigate options for lower cost public listing.
- Pass the Financial Markets Conduct Bill to make it easier for listed companies to raise capital.
- Make it easier for businesses to offer employee share schemes.
- Pass the Financial Reporting Bill to reduce unnecessary financial reporting costs for business.
- Established the Financial Markets Authority to promote and facilitate the development of fair, efficient and transparent financial markets.

- Implement improvements to incubator programmes.
- Additionally \$31.3m over four years has been set aside for a new repayable grants for start-ups programme.

Attracting foreign investment

- Encourage a more positive environment for international investment and explain the benefits to New Zealanders.
- Align business law between New Zealand and Australia.

Supporting early stage and growth capital

- Increase access to capital for small, high-growth businesses by supporting the New Zealand Venture Investment Fund.
- Deliver targeted services such as Better by Capital to help internationalising New Zealand firms raise capital.
- Enhance NZ Export Credit Office products and service.
- Enable crowd funding and peer-to-peer lending.
- Provide more options for SMEs to raise capital by clarifying and widening disclosure exceptions for SMEs seeking to raise capital (e.g. offers to experienced investors, small offers).



SNAPSHOTS AND KEY METRICS

High technology manufacturing

Cross-cutting sector

Situation

The technology level of manufacturing is defined internationally by the average share of revenue that each industry spends on research and development. When examined across multiple countries combined, high technology manufacturing industries are currently defined as those that spend over 8% of their collective revenue on research and development.

Scorecard						Example firms			
Measure	Total	% of NZ*	Growth (1 year)	Growth (5 yr CAGR)	Growth (10 yr CAGR)	Firm	Turnover (\$m)	Employees	Ownership
GDP 2010 (nominal)	\$1,181m	0.7%	-3.8%	2.7%	n/a	Fisher & Paykel Healthcare	\$517	2,600	Listed; NZ (NZX: FPH)
Real GDP 2012	n/a	n/a	n/a	n/a	n/a	Tait Communications	~\$200	930	Private; NZ (charitable trusts)
Goods exports 2012	\$1,392m	3.1%	6.6%	3.8%	n/a	Rakon	\$178	2,300	Listed; NZ (NZX: RAX)
Employment 2011	14,217	0.6%	0.5%	0.0%	2.5%	Gallagher	\$187	760	Private; NZ (Gallagher family)
Value added / employee 2010 (nominal)**	\$83,448	115.3%**	-2.0%	1.9%	n/a	Dynamic Controls	\$92	391	Listed; USA (NYSE: IVC)
Net investment in fixed assets 2010	\$97m	0.3%	5.3%	n/a	n/a				
No. of firms 2012	1,016	0.2%	1.1%	0.9%	2.1%				

Industry level financial performance				
	Total		Growth (1yr)	
	This sector	All sectors	This sector	All sectors
Total income per firm 2011 [#]	\$3,751,000	\$1,295,000	12%	5.2%
Total income per employee 2011 [#]	\$282,400	\$311,600	8.3%	4.0%
Surplus per employee 2011 [#]	\$21,079	\$24,000	34%	-13%
Return on equity 2011 [#]	19%	6.6%	up	down
Debt ratio (liabilities/assets) 2011 [#]	51%	64%	up	down
Fixed assets per worker 2011	n/a	\$169,364	n/a	5.2%

* NZ is total employing firms, except for productivity where it is the total measured sector .

** Cross-cutting sector: uses value added per employee for productivity, NZ average = 100%.

All sectors total excludes some industries: refer to methodology and sources.

Leading export goods		Exports by destination	
Product	Exports (NZ\$m; 2012)	Country	Exports (NZ\$m; 2012)
Therapeutic respiration devices	\$287.2	Australia	\$330
Piezo-electric quartz crystals	\$87.8	USA	\$286
Medicines for humans	\$62.5	China & HK	\$96
Medicines for animals	\$61.8	UK	\$75
Radio telephones	\$57.1	France	\$65
Other	\$897.4	Other	\$540
TOTAL all exports	\$1,392	TOTAL All countries	\$1,392

Medium-high technology manufacturing

Cross-cutting sector

Situation

The technology level of manufacturing is defined internationally by the average share of revenue that each industry spends on research and development. When examined across multiple countries combined, medium-high technology manufacturing industries are currently defined as those that spend between 2% and 8% of their collective revenue on research and development.

Scorecard						Example firms			
Measure	Total	% of NZ*	Growth (1 year)	Growth (5 yr CAGR)	Growth (10 yr CAGR)	Firm	Turnover (\$m)	Employees	Ownership
GDP 2010 (nominal)	\$2,426m	1.5%	-11.9%	-4.3%	n/a	Fisher and Paykel Appliances	\$1,000	3,050	Foreign (Haier Group)
Real GDP 2012	n/a	n/a	n/a	n/a	n/a	Glidepath	\$75	200	Private
Goods exports 2012	\$2,792m	6.2%	-2.6%	-1.0%	n/a	Buckley Systems	\$70	270	Private
Employment 2011	33,117	1.5%	-1.1%	-2.9%	-1.6%	Compac Sorting Equipment	\$83	310	Private
Value added / employee 2010 (nominal)**	\$72,422	100.0% (i.e.=NZ)	-3.9%	-1.1%	n/a	Scott Technology	\$54	225	Listed, NZX
Net investment in fixed assets 2010	-\$55m	-0.2%	-114.2%	n/a	n/a				
No. of firms 2012	4,052	0.9%	-0.9%	-0.2%	0.7%				

Industry level financial performance				
	Total		Growth (1yr)	
	This sector	All sectors	This sector	All sectors
Total income per firm 2011 [#]	\$2,464,775	\$1,294,500	5.6%	5.2%
Total income per employee 2011 [#]	\$340,396	\$311,600	5.2%	4.0%
Surplus per employee 2011 [#]	\$22,631	\$24,000	111.9%	-12.7%
Return on equity 2011 [#]	16%	6.6%	up	down
Debt ratio (liabilities/assets) 2011 [#]	50%	64%	up	down
Fixed assets per worker 2011	n/a	\$169,364	n/a	5.2%

Leading export goods		Exports by destination	
Product	Exports (NZ\$m; 2012)	Country	Exports (NZ\$m; 2012)
Specialised machinery and equipment	\$759	Australia	\$1,327m
Electrical equipment	\$509m	USA	\$351m
Other machinery and equipment	\$315m	China & HK	\$115m
Domestic appliances	\$259m	Japan	\$103m
Motor vehicles and parts	\$173m	UK	\$37m
Other	\$777m	Other	\$859m
TOTAL all exports	\$2,792m	TOTAL All countries	\$2,792m

* NZ is total employing firms, except for productivity where it is the total measured sector .

** Cross-cutting sector: uses value added per employee for productivity, NZ average = 100%.

All sectors total excludes some industries: refer to methodology and sources.

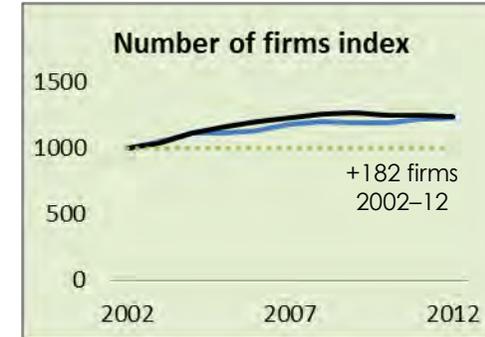
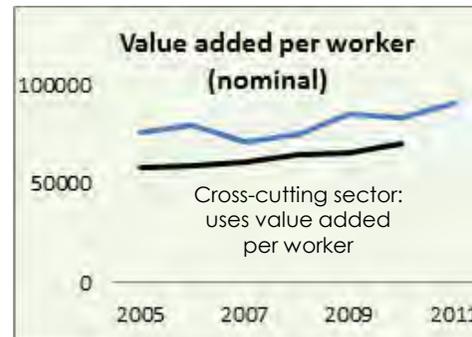
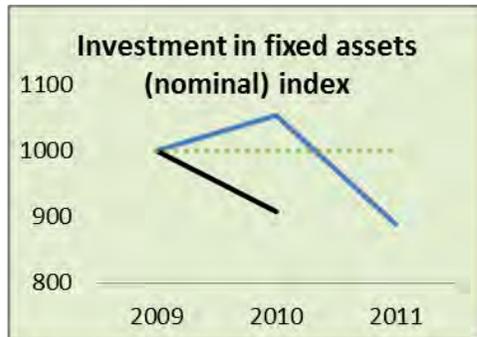
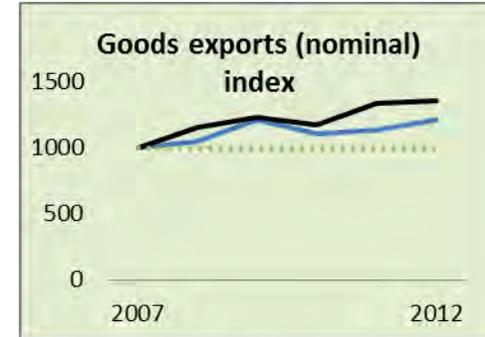
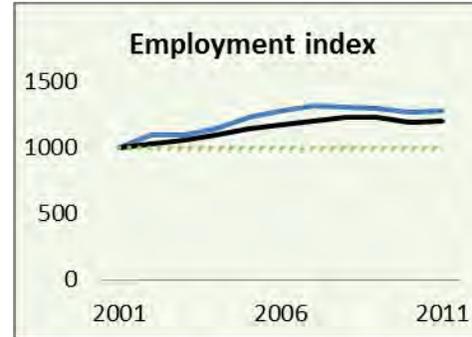
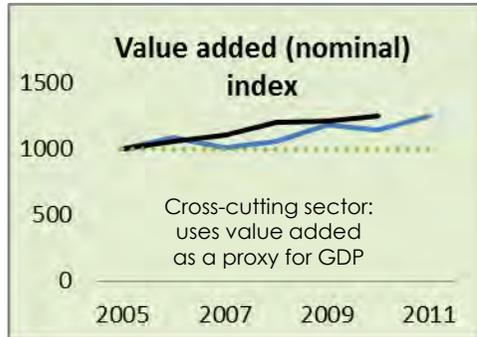
High technology manufacturing

Cross-cutting sector

Key trends, various timeframes: 10-year index (base=1000) except productivity is \$ values – this sector vs all other sectors

Comment

- Share of GDP growing
- Small employer: 14,217 employees
- More workers overall: +3,066 (2001–11)
- Lost workers: -216 (2008–09)
- Gained workers: +186 (2010–11)
- Highly productive
- Nominal export values growing 2010–2012, after GFC dip (2008–09)
- Number of firms increasing slowly
- Investment in fixed assets stable, averaging \$90m per annum 2009–11
- Highest R&D rate: 45% of firms
- Highest innovation rate: 75% of firms
- Return on equity 19% (2011)
- Highly internationalised sector



Key

- High tech
- Other employing sectors
- Starting point = 1000
- Measured sector

R&D & innovation rates	Export barriers: Current exporters	% firms	Export barriers: Future exporters	% firms	Internationalisation	%
R&D rate (% of firms)	1. Exchange rate volatility		1. Limited access to distribution networks		% of high technology firms exporting	70%
Innovation rate (% of firms)	2. Exchange rate level		2. Limited experience in expanding beyond NZ		% of high technology firms with overseas holdings	17%
	3. Low market demand or increased competition in overseas markets		3. Limited knowledge about specific markets / Language and cultural differences		% of high technology firms >50% foreign owned	13%

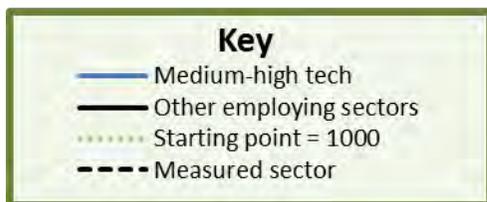
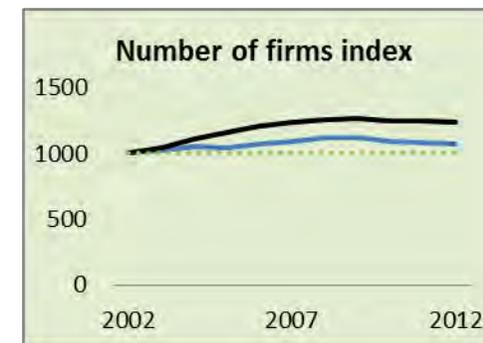
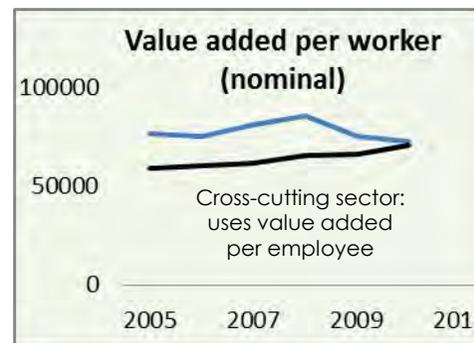
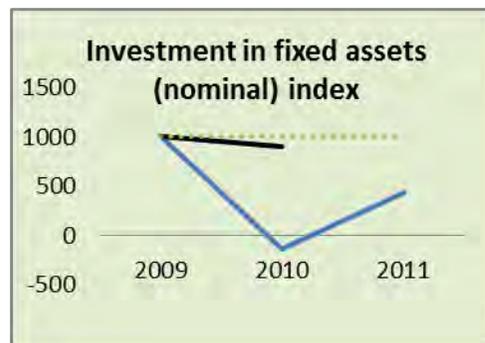
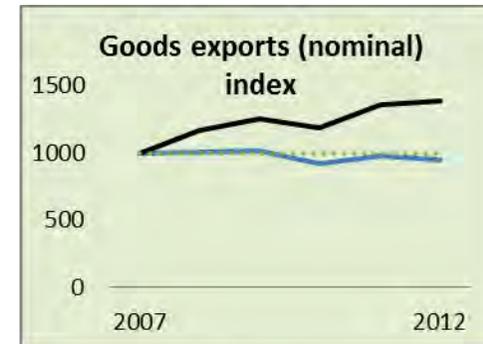
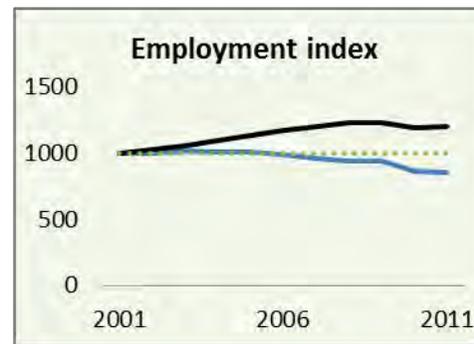
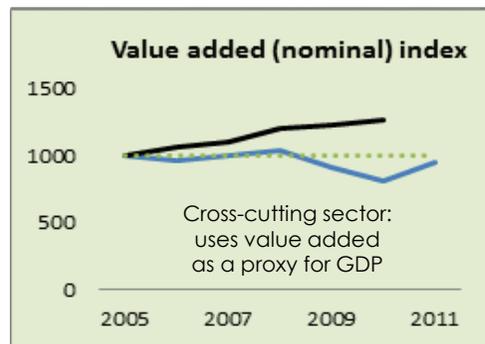
Key

- High
- ◐ Medium
- Low

Key trends, various timeframes: 10-year index (base=1000) except productivity is \$ values – this sector vs all other sectors

Comment

- Share of GDP has fallen
- Medium sized sector for employment: 33,117 workers
- Lost workers overall: -5,763 (2001-2011)
- Number of firms declining since 2009
- Nominal export values declining
- Number of firms declining
- Identification of distance and increased competition in overseas markets as barriers possibly reflects nature of goods exported, e.g. whiteware versus health technologies.



R&D & innovation rates	Export barriers: Current exporters	% firms	Export barriers: Future exporters	% firms	Internationalisation	%
R&D rate (% of firms) ●	1. Distance from markets ●		1. Limited experience in expanding beyond NZ ●		% of medium-high technology firms exporting	50%
Innovation rate (% of firms) ●	2. Low market demand or increased competition in overseas markets ●		2. Distance from markets ●		% of medium-high technology firms with overseas holdings	12%
	3. Exchange rate level / exchange rate volatility, ●		3. Limited access to distribution networks ●		% of medium-high technology firms >50% foreign owned	10%



Other key comparisons

High technology manufacturing exhibits greater innovation and export intensity, with faster revenue growth overall

Metric	High technology manufacturing			Medium-high technology manufacturing		
Revenue	Number	Performance	Change	Number	Performance	Change
Combined total sector revenues	\$3.8b (2011)	3.5% 5 yr CAGR (2006-11)	+\$597m (2006-11)	\$10.1b (2011)	-0.2% 5 yr CAGR (2006-2011)	-\$96m (2006-11)
Exports						
% of sector's income from exports	29% (2012)	n/a	-10.7 % point change (2012 vs 2007)	18% (2012)	n/a	+3.9 % point change (2012 vs 2007)
R&D						
Average expenditure by firms doing R&D	\$1.3m	n/a	n/a	\$0.4m	n/a	n/a
Average expenditure on R&D as % of production: range among sub-sectors*	0.9%–6.9%	n/a	n/a	0.3%–2.3%	n/a	n/a
Innovation						
Percentage of firms reporting product innovations	53%	n/a	n/a	40%	n/a	n/a
Productivity						
Value added as % of sales	35%		-1.8 % point change (2011 vs 2010)	29%		+3.0 % point change (2011 vs 2010)

* For example, sub-sectors of high technology manufacturing include pharmaceuticals, aircraft manufacturing, professional and scientific equipment manufacturing (including medical technologies) and computer and electronic manufacturing. Subsectors of medium-high technology manufacturing include polymers, chemicals (excluding pharmaceuticals), transport equipment, and machinery and equipment.



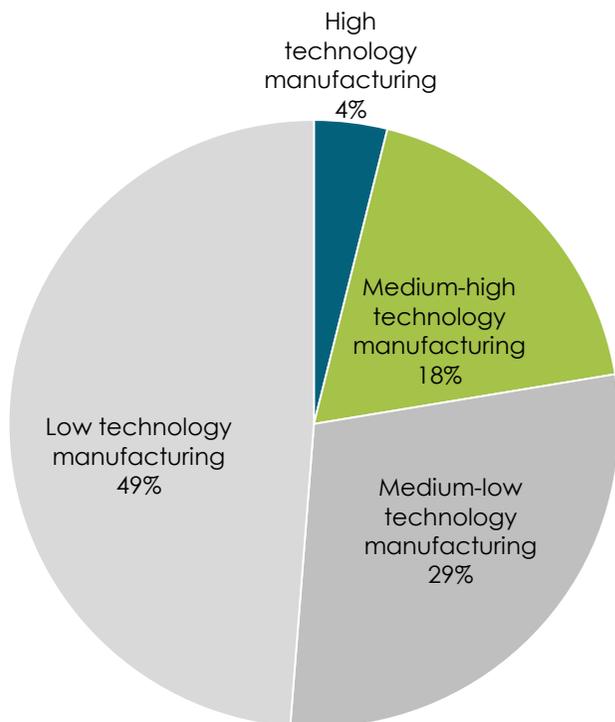
BUSINESS AND EMPLOYMENT

Manufacturing context

In manufacturing, the high and medium-high technology sectors together comprise 22% of economically significant firms*, 17% of GDP, and 12% of goods exports

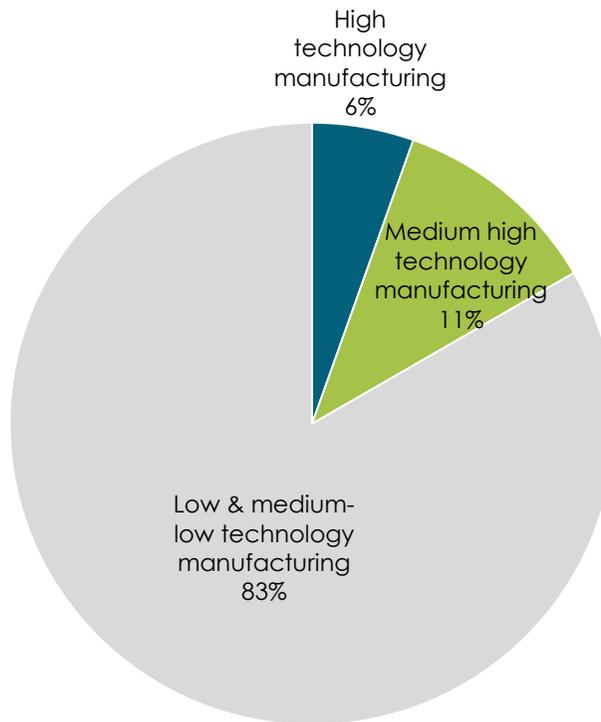
Share of manufacturing firms*

2012; *firms with >5 employees only



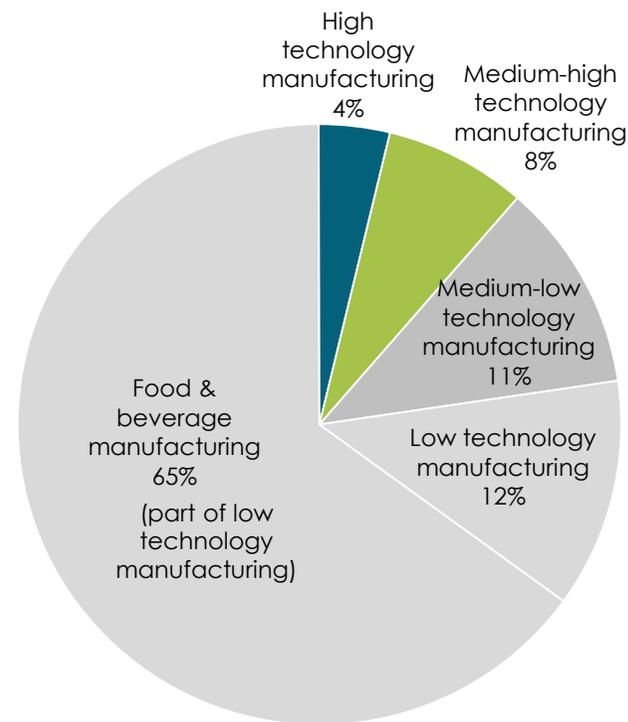
Share of manufacturing GDP

2010; value added; manufacturing only



Share of manufacturing goods exports

YE June 2012; manufacturing sector only

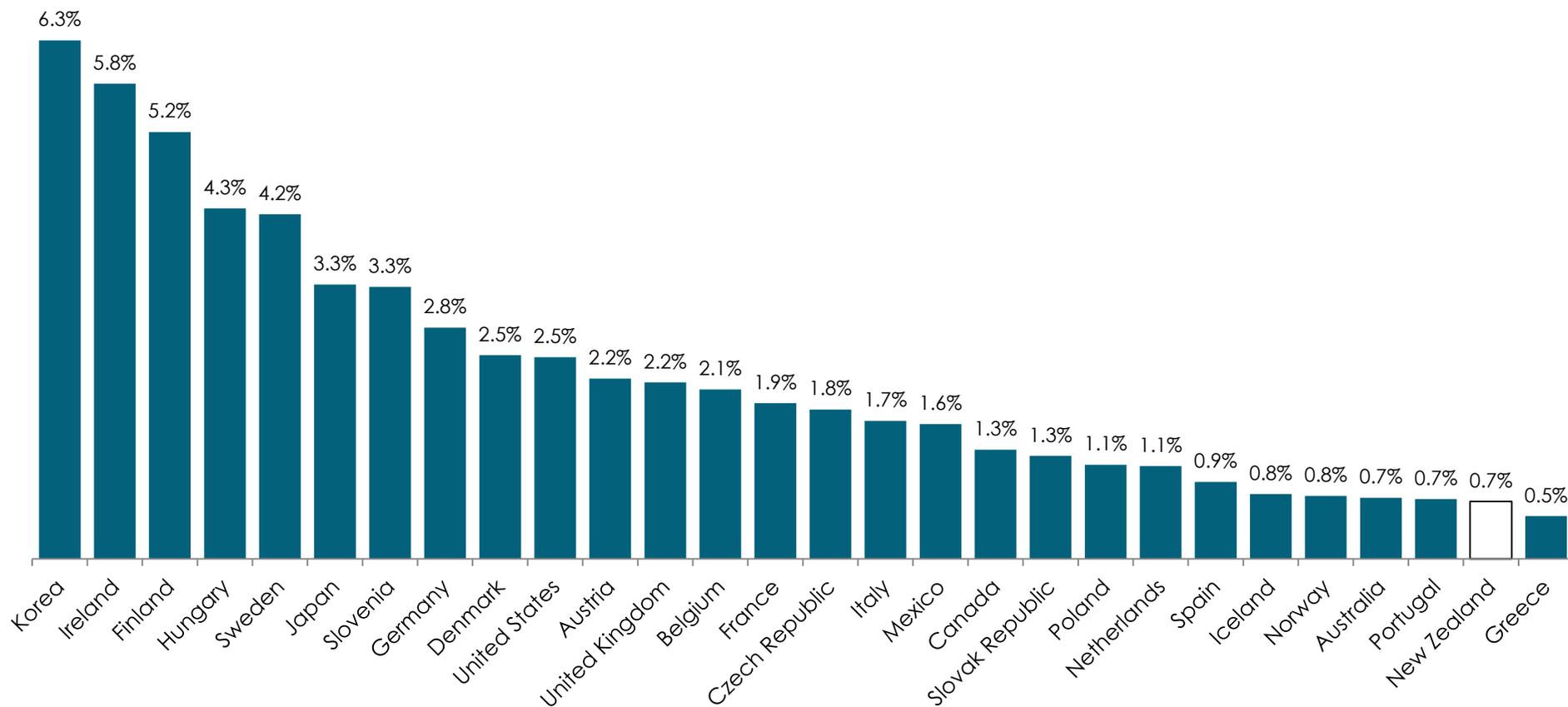


Contribution to GDP: high technology manufacturing

While the high technology manufacturing sector forms only a small part of each developed economy, New Zealand's sector is one of the smallest

Value added of the high technology manufacturing sector as a share of the total economy

% of total economy; OECD: 2005, NZ: 2010

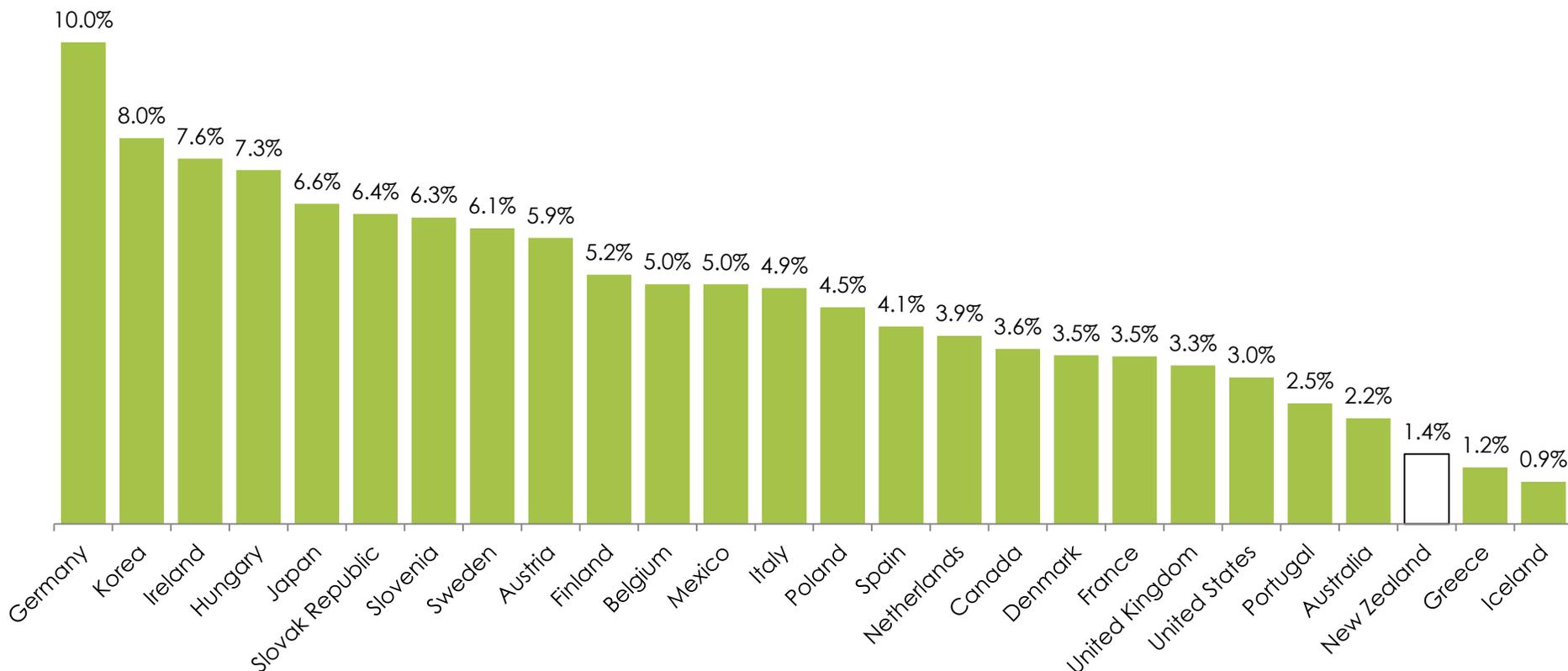


Contribution to GDP: medium-high technology manufacturing

While the medium-high technology sector forms a larger share of the economy than the high technology sector, it is still small compared to other developed countries

Value added of the medium-high technology manufacturing sector as a share of the total economy

% of total economy; OECD: 2005, NZ: 2010

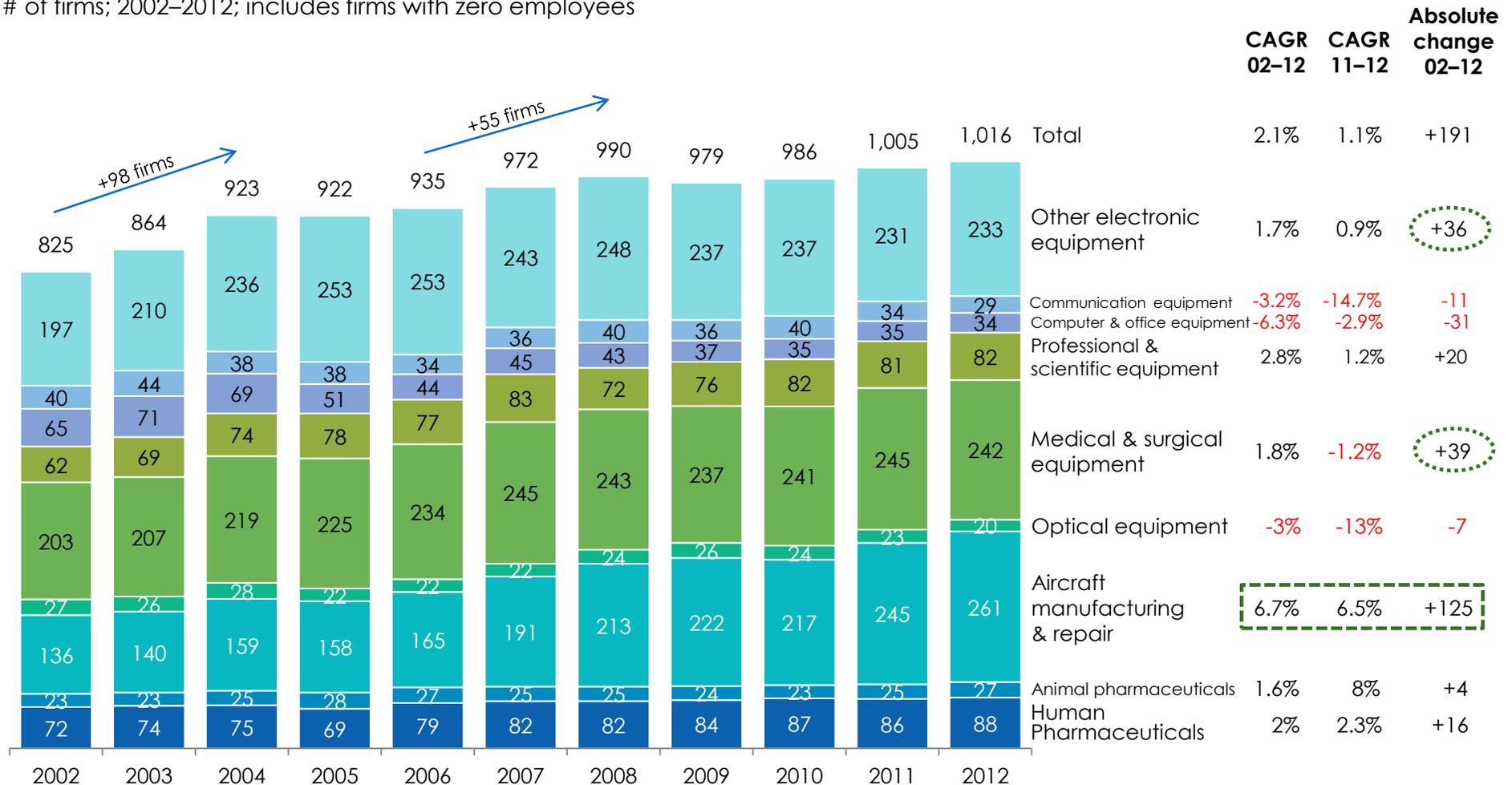


High technology manufacturing: number of firms by sub-sector

Firm numbers grew to 2008; growth resumed from 2010 but at a slower rate

Number of firms in high technology manufacturing, by sub-sector

of firms; 2002–2012; includes firms with zero employees

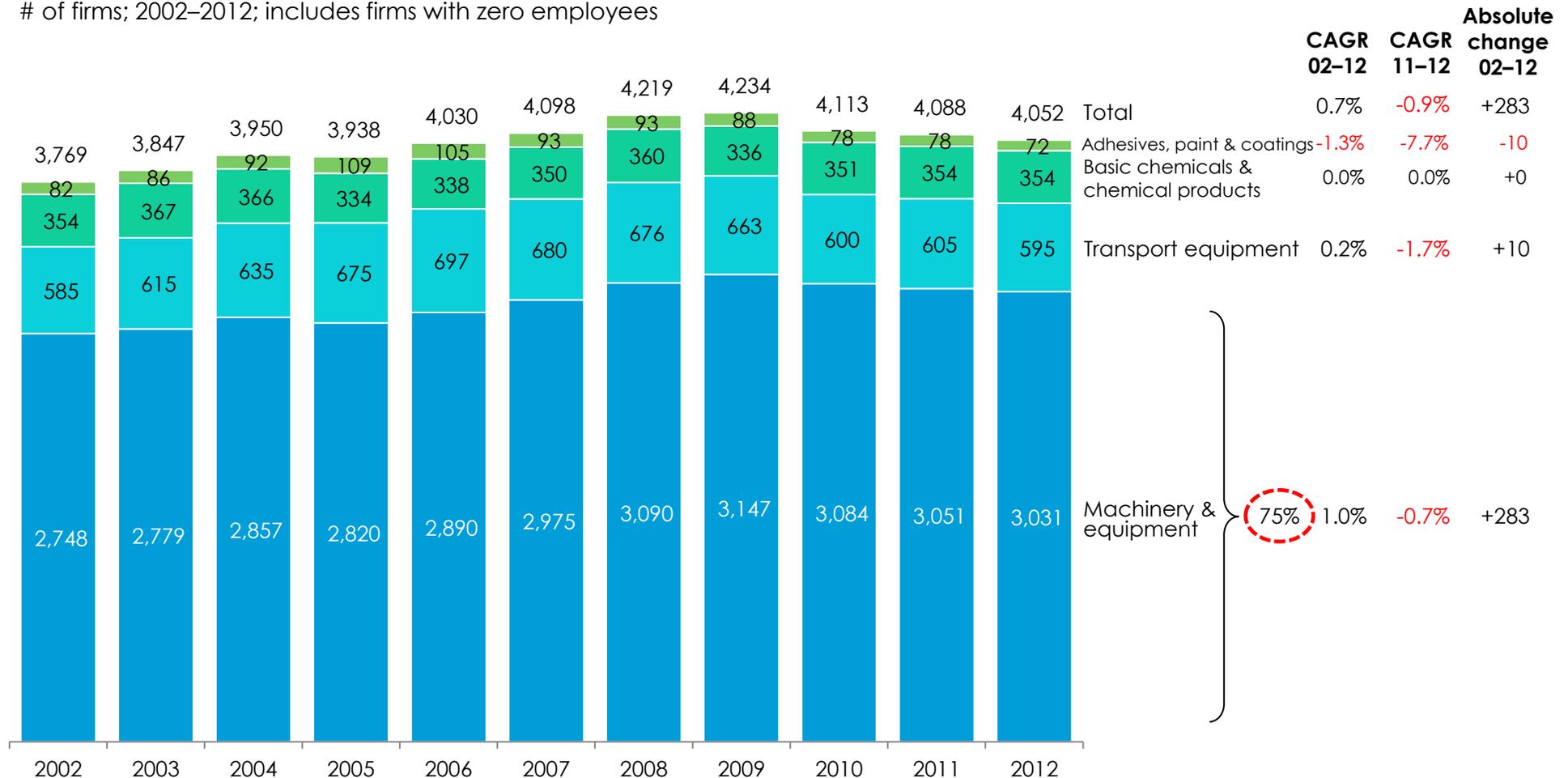


Medium-high technology manufacturing: number of firms by sub-sector

75% of medium-high technology firms are in machinery and equipment manufacturing; firm numbers have been relatively stable over the last decade

Number of firms in medium-high technology manufacturing, by sub-sector

of firms; 2002–2012; includes firms with zero employees

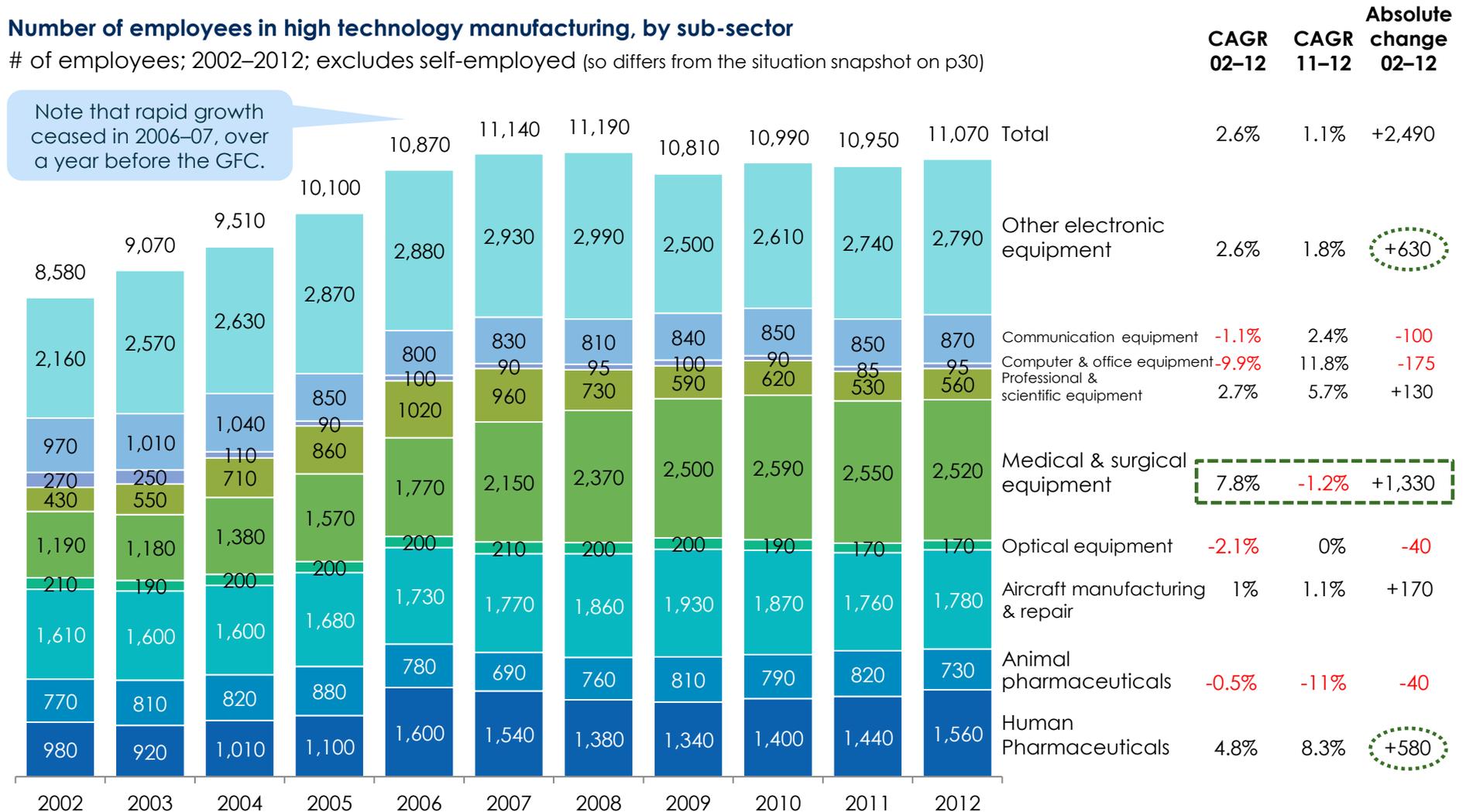


High technology manufacturing: number of employees by sub-sector

Employment in high technology manufacturing firms grew rapidly until 2006, driven by medical & surgical equipment, but has plateaued since

Number of employees in high technology manufacturing, by sub-sector

of employees; 2002–2012; excludes self-employed (so differs from the situation snapshot on p30)



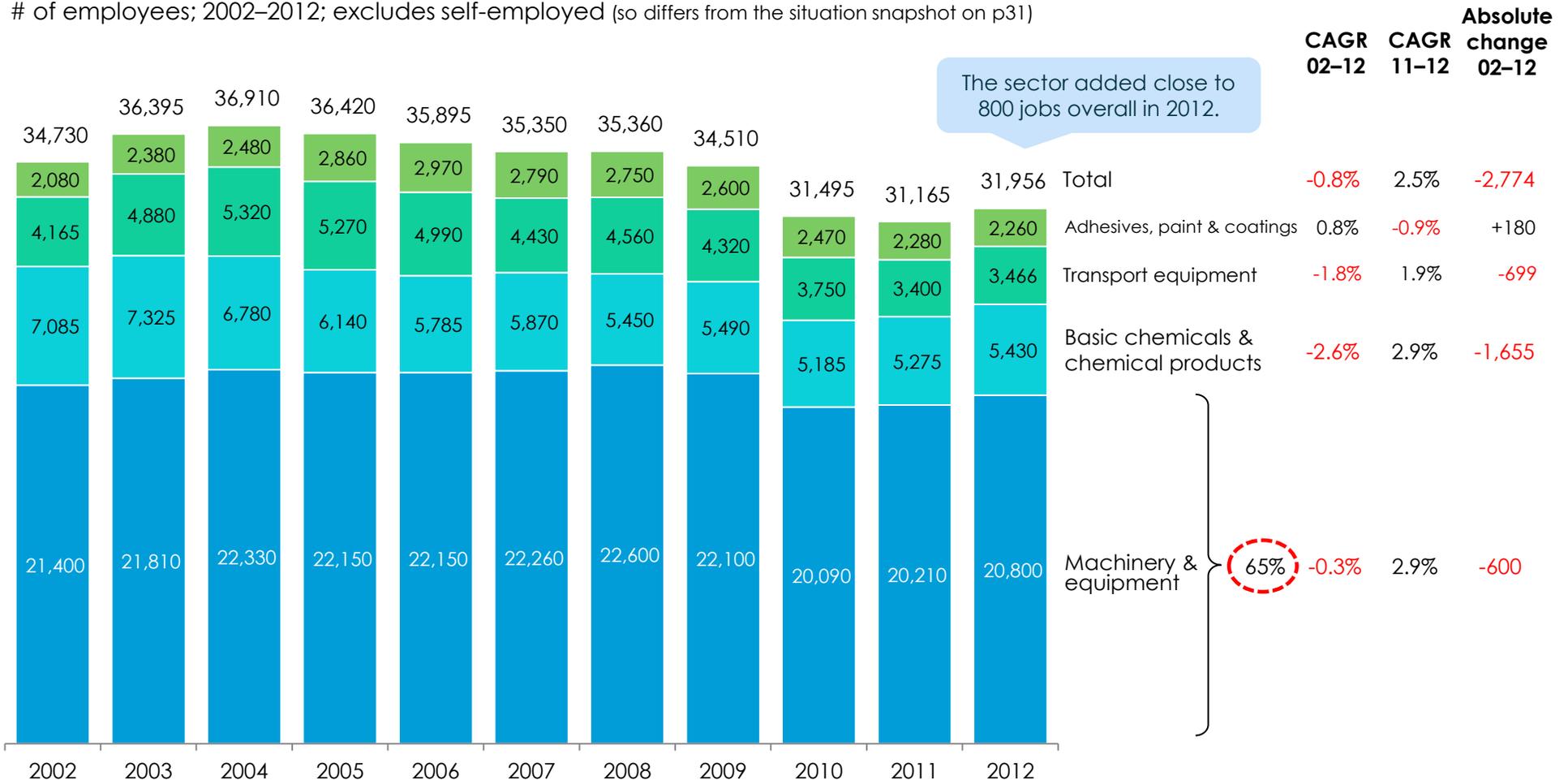
Source: Statistics New Zealand, Business Demography Statistics. CAGR = compound annual growth rate.

Medium-high technology manufacturing: number of employees by sub-sector

Employment peaked in 2004 and dropped sharply in 2010 across all sub-sectors; employment picked up in 2012

Number of employees in medium-high technology manufacturing, by sub-sector

of employees; 2002–2012; excludes self-employed (so differs from the situation snapshot on p31)



Source: Statistics New Zealand, Business Demography Statistics. CAGR = compound annual growth rate.

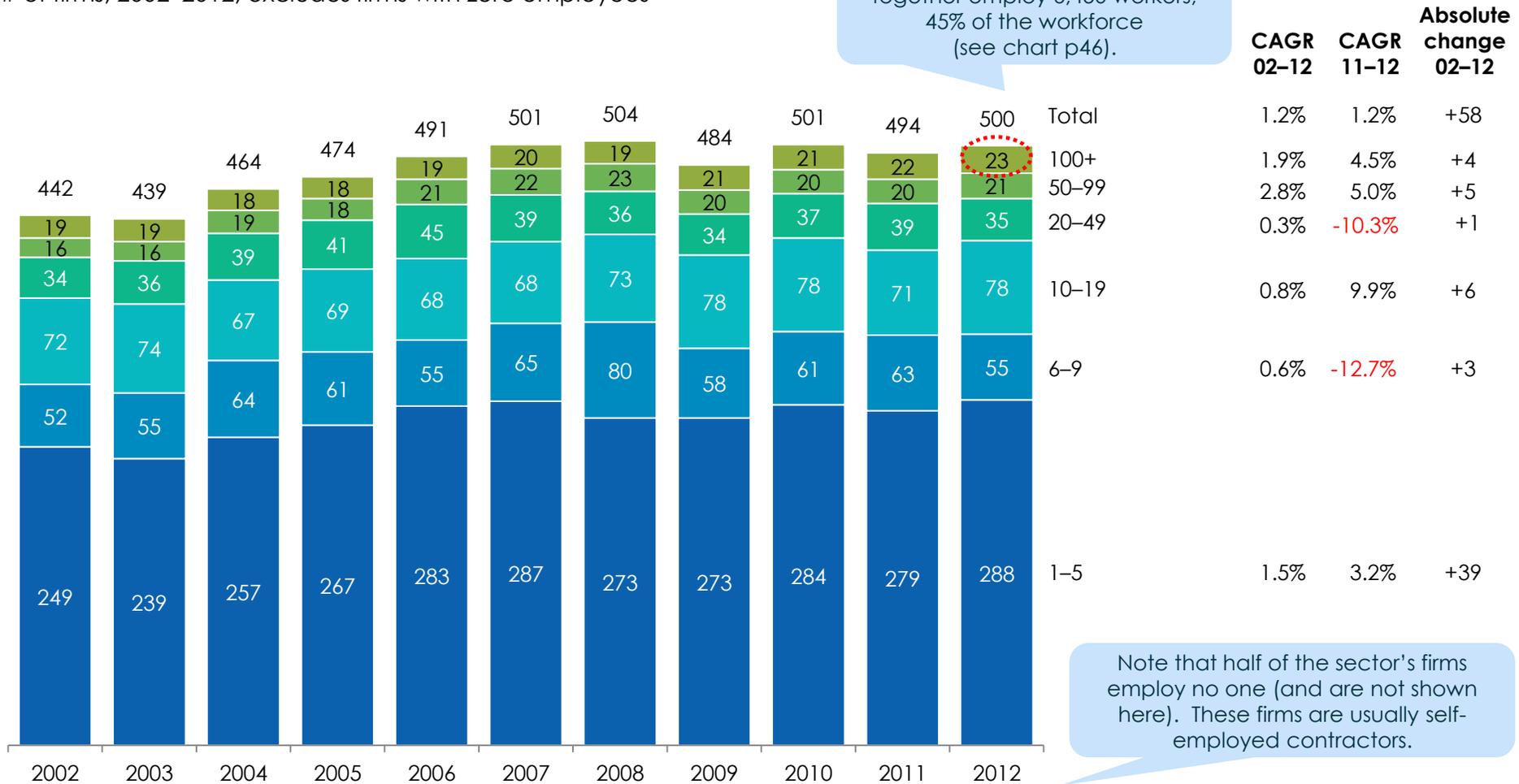
High technology manufacturing: firms by employment size

The sector has 9 more large firms (>50 employees) than it did a decade ago, and 49 more smaller ones (1–49 employees)

Number of high technology manufacturing firms by employee numbers

of firms; 2002–2012; excludes firms with zero employees

The 23 firms with >100 employees together employ 6,450 workers, 45% of the workforce (see chart p46).



Note that half of the sector's firms employ no one (and are not shown here). These firms are usually self-employed contractors.

Source: Statistics New Zealand, Business Demography Statistics (2012). CAGR = compound annual growth rate.

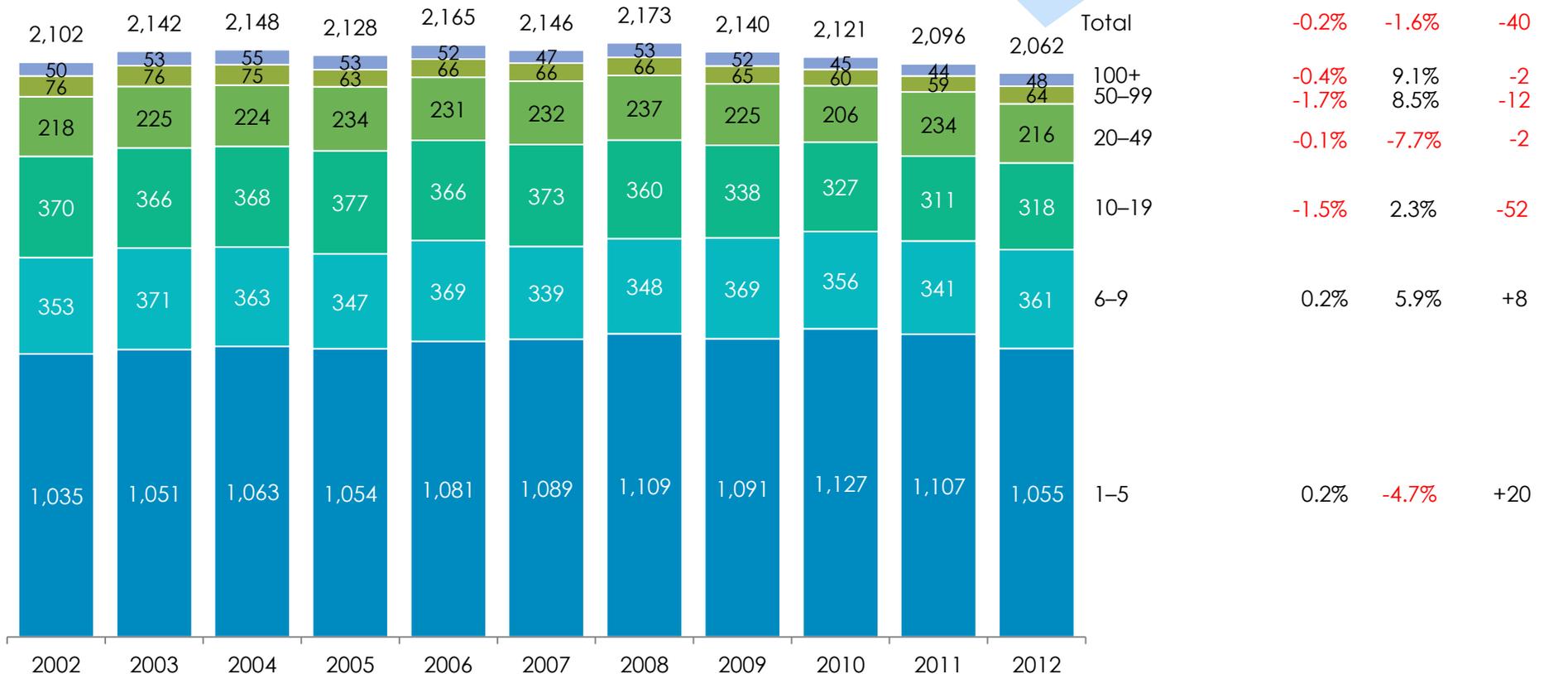
Medium-high technology manufacturing: firms by employment size

Firm numbers have been relatively stable; overall the sector only lost 40 firms in the last decade

Number of medium-high technology manufacturing firms by employee numbers

of firms; 2002–2012; excludes firms with zero employees

The 48 firms with >100 employees together employ 11,260 workers, 35% of the workforce (see chart p47).



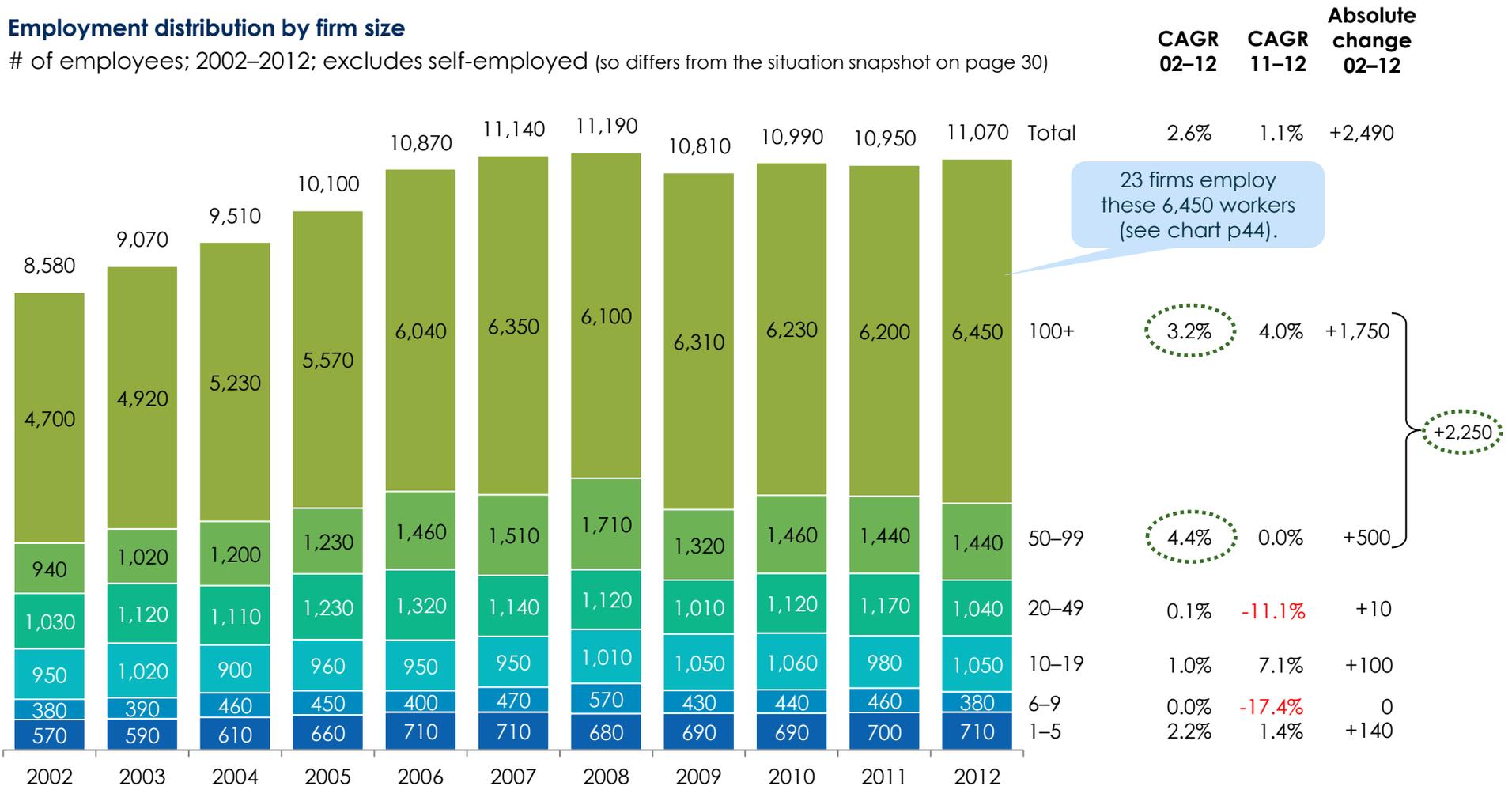
Source: Statistics New Zealand, Business Demography Statistics (2012). CAGR = compound annual growth rate.

High technology manufacturing: employees by firm size

Larger firms (>50 employees) dominate the sector and have driven employment growth, adding 2,220 jobs in the five years to 2007, but only 30 jobs since

Employment distribution by firm size

of employees; 2002–2012; excludes self-employed (so differs from the situation snapshot on page 30)



Medium-high technology manufacturing: employees by firm size

Large firms (>50 employees) drove employment decline, shedding 4,800 jobs from 2004–2011, but these firms added just over 1,000 jobs in the year to February 2012

Employment distribution by firm size

of employees; 2002–2012; excludes self-employed (so differs from the situation snapshot on page 31)



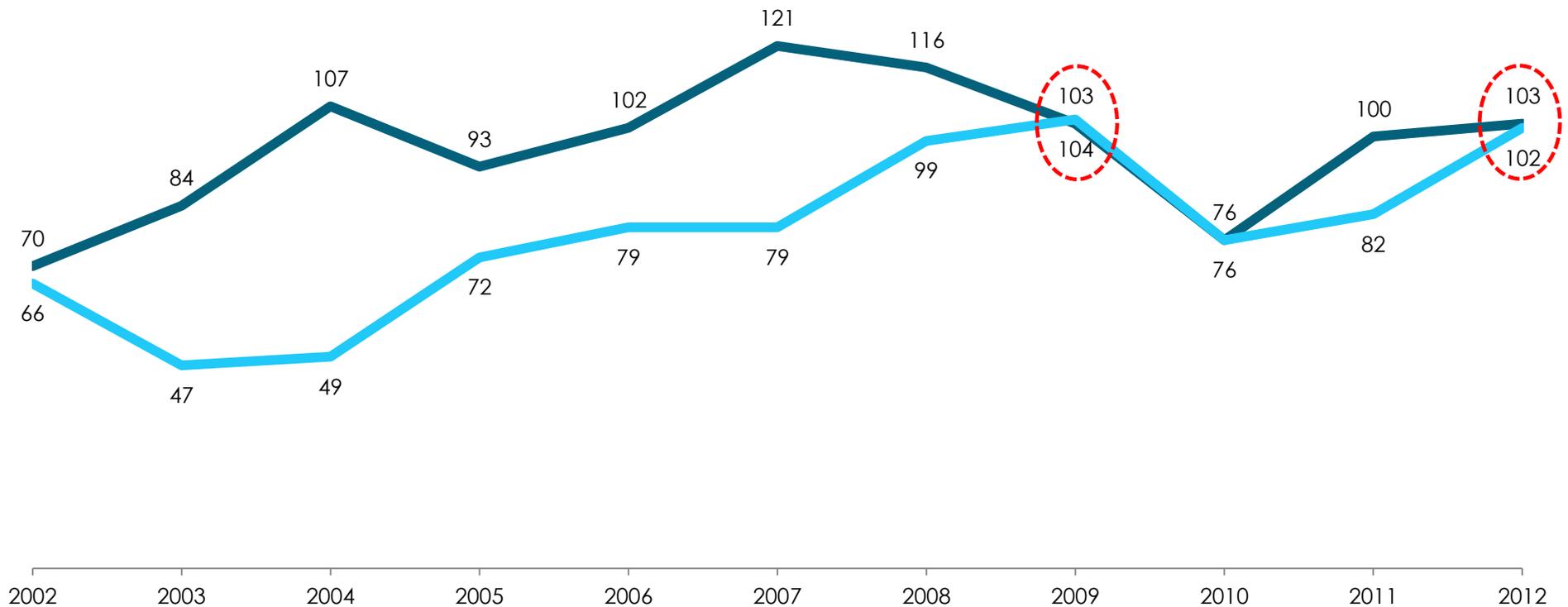
High technology manufacturing: firm births and deaths

10% of the sector's firms ceased doing business in 2012, similar to during the GFC (2008–2009), but the establishment of new firms has been marginally ahead of firm deaths

Number of births and deaths of high technology manufacturing firms

of firms; 2002–2012

— Births
— Deaths

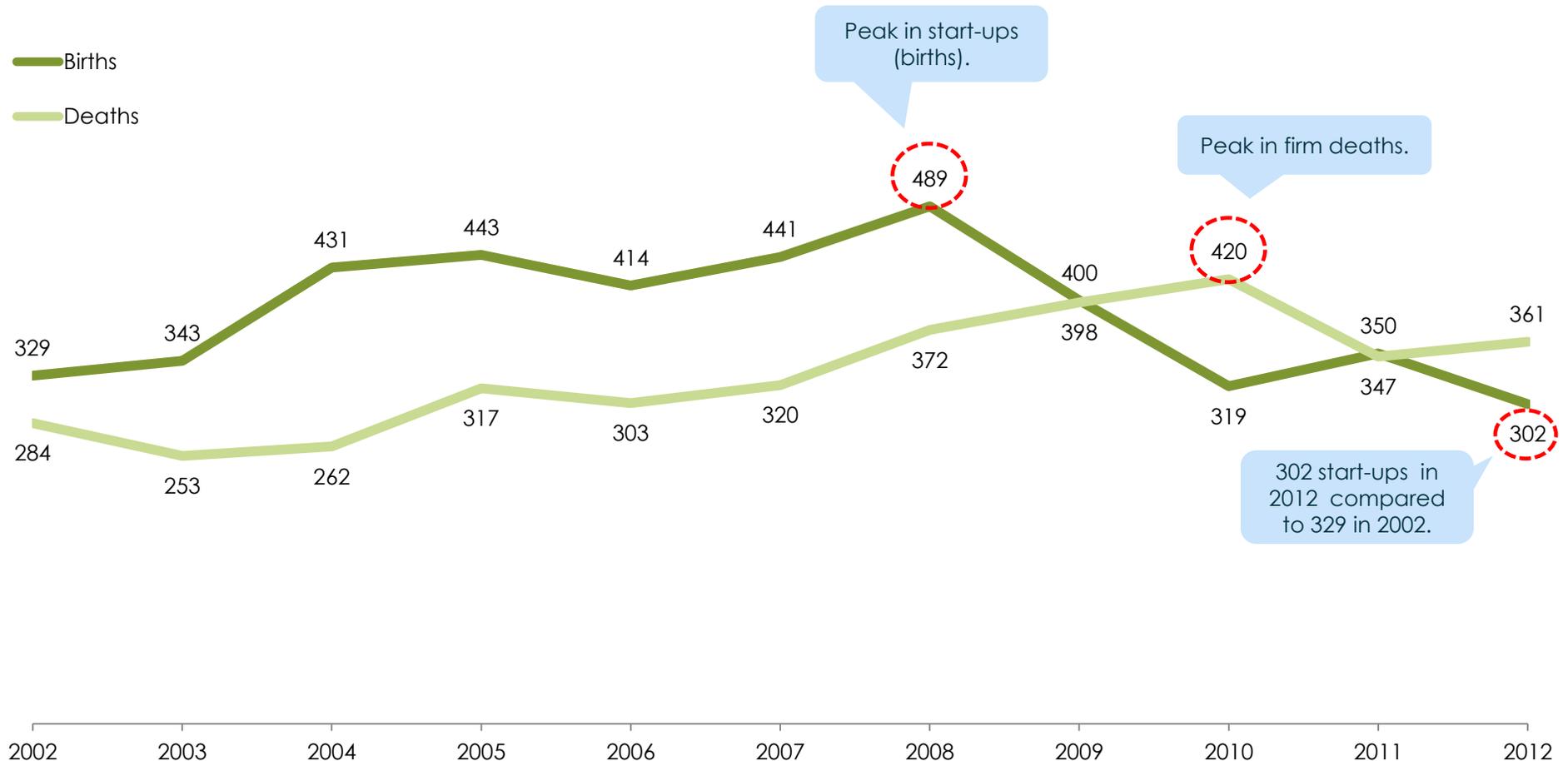


Medium-high technology manufacturing: firm births & deaths

The annual establishment of new firms grew until the GFC, but is now at its lowest level for a decade

Number of births and deaths of medium-high technology manufacturing firms

of firms; 2002–2012

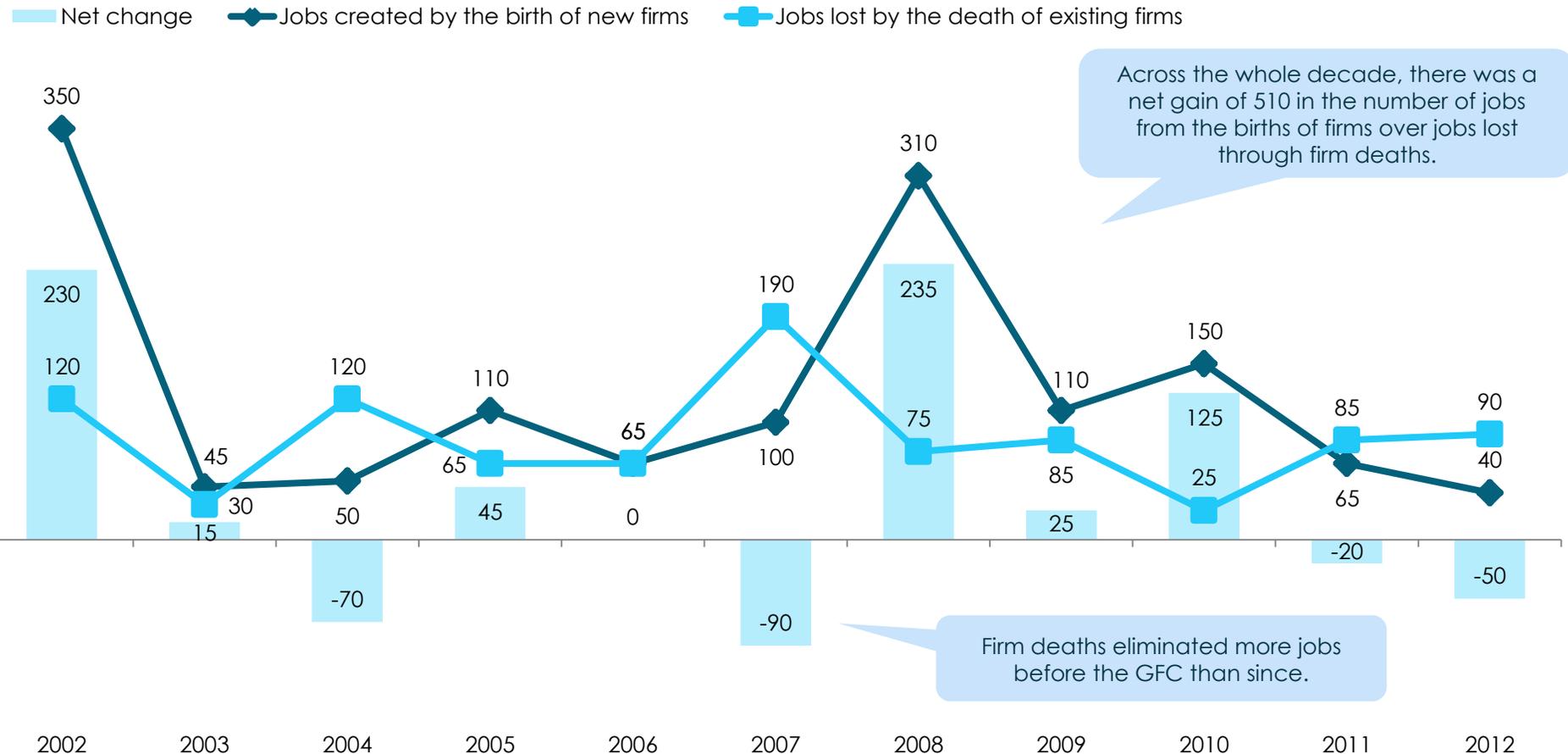


High technology manufacturing: job creation and elimination

Over the last decade, the establishment of new high technology manufacturing firms has created more jobs than those lost by the closure of existing firms

Number of jobs created and eliminated by firm births and deaths

of employees; year to February; 2002–2012

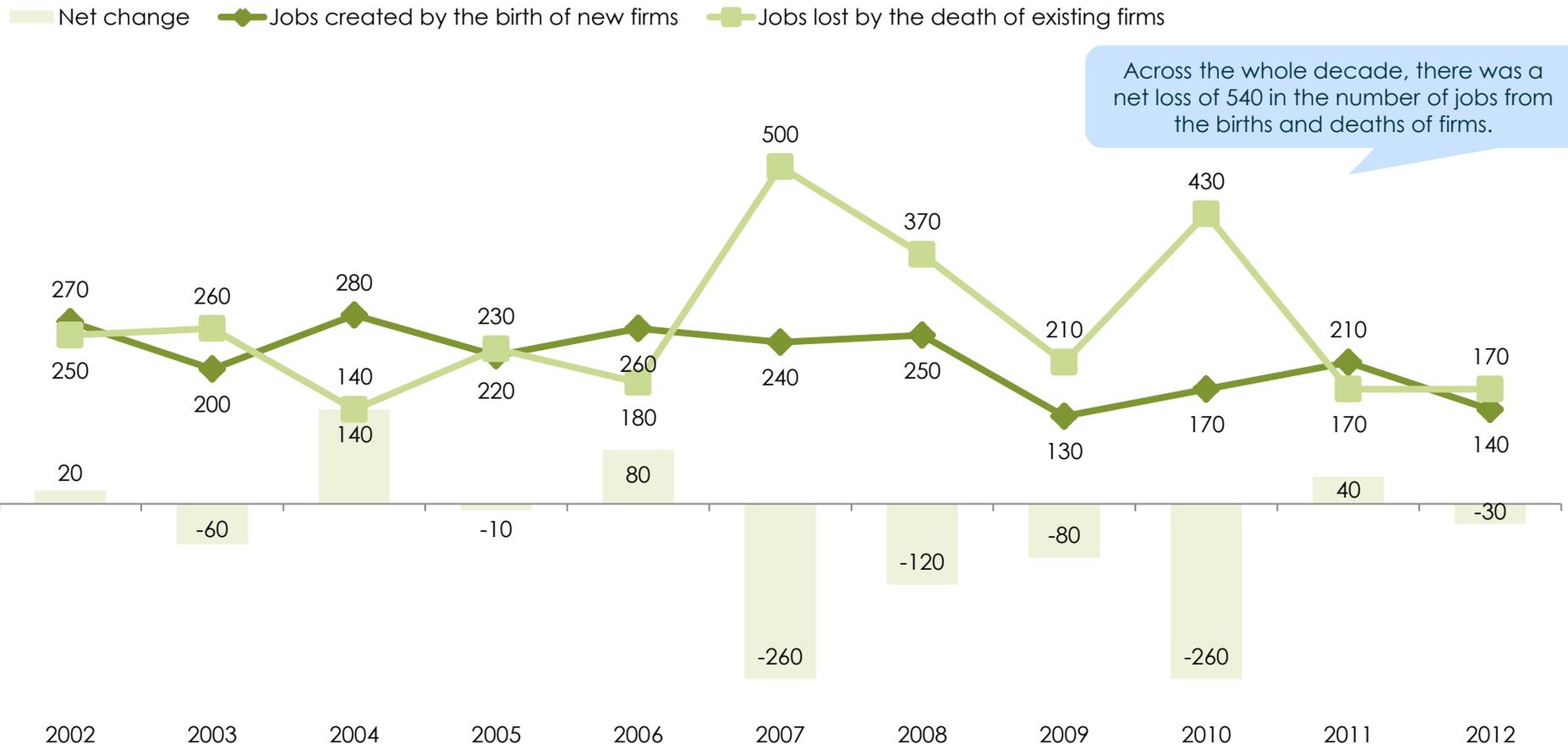


Medium-high technology manufacturing: job creation and elimination

Over the last decade, 5 large firms (> 50 employees) have gone out of business, accounting for up to a third of the 2,900 jobs lost as a result of firms ceasing to do business

Number of jobs created and eliminated by firm births and deaths

of employees; year to February; 2002–2012



Impact of the GFC: industry comment

Industry leaders commented that the GFC affected growth and capital markets, particularly for firms in the early stages of their development

- *I don't know too many people who've gone up in a puff of smoke. You just hang in there. You delay your employment, or you start cutting back. You just do whatever it takes to survive at that point.*
 - CEO, med-high technology firm
- *Fund raising in the States is at about 30% of the 2007 levels. There's a lot less capital available in the venture system. In Europe, UK, it's pretty dire. Australia, I don't think has raised a meaningful new fund; just these small \$25 to \$30 million funds, which are not viable. I don't think there's been much to write home about in New Zealand either. ...It's a much tougher financial environment.*
 - Venture capitalist
- *We were raising capital for one of our businesses in New York from the beginning of '08. We had this fantastic list of investors that were coming on board and getting into due diligence. The week Bear Stearns failed [in March 2008], most of that list disappeared. Over the next 3 weeks the remainder of the list disappeared. The US became a dry hole for investment from pretty much then on in. So [for] the small end of town [i.e. early stage businesses], they absolutely got hit with the lack of capital from the GFC. That was an absolutely profound knock.*
 - Venture capitalist
- *I think you need to put more emphasis on the impact that the GFC has had on the high tech sector.*
 - Partner, technology law firm

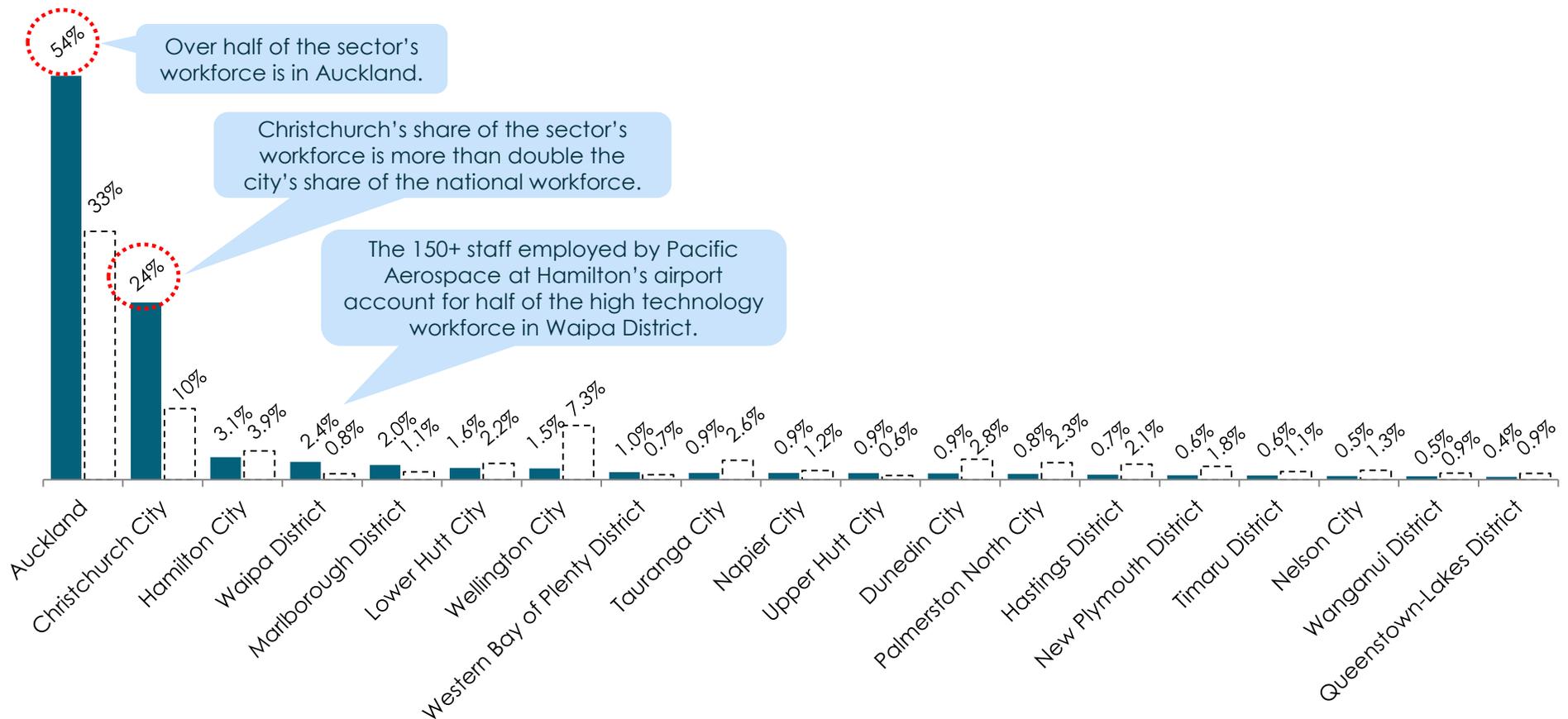
High technology manufacturing: location

High technology manufacturing is concentrated in Auckland and Christchurch (78% of the workforce), where New Zealand's large manufacturing firms are located

Share of high technology manufacturing employees vs share of all employees

% of employees; 2012

■ Share of high technology manufacturing jobs □ Share of total jobs



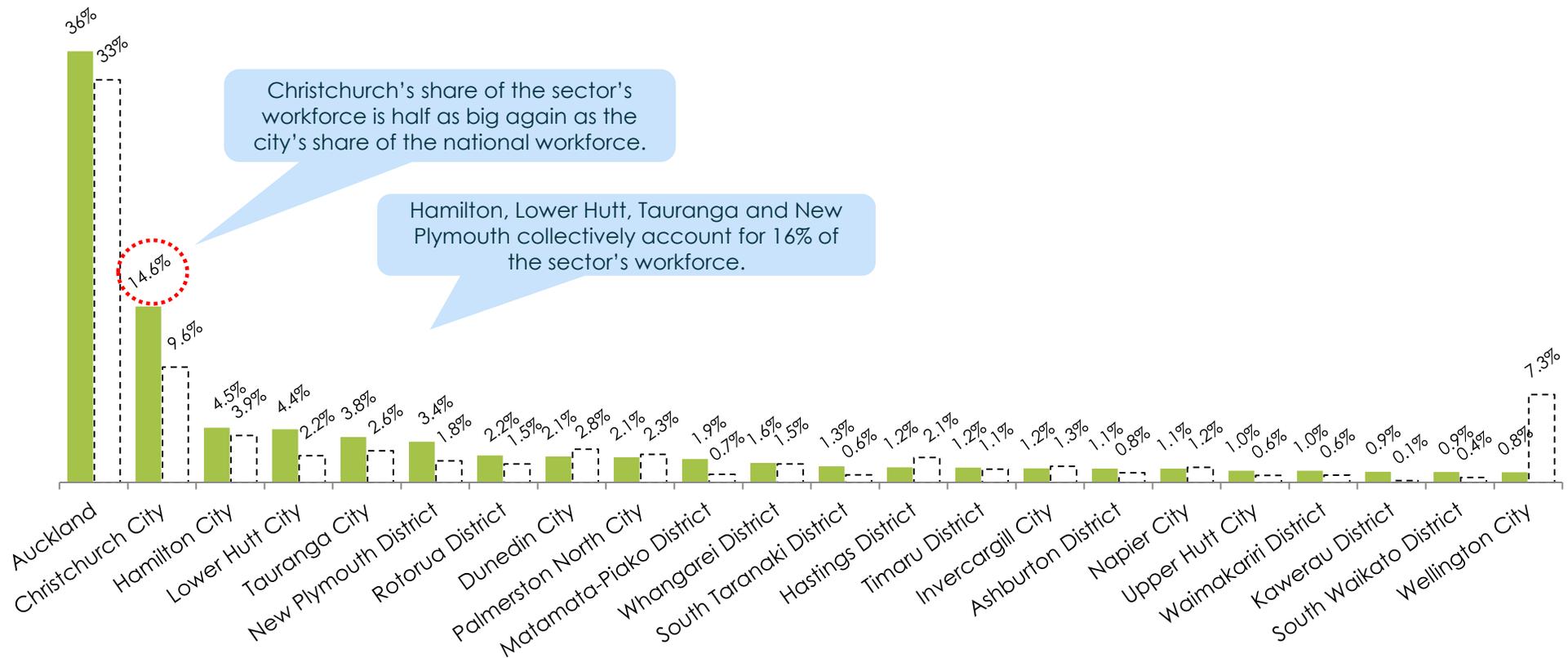
Medium-high technology manufacturing: location

Auckland and Christchurch account for 51% of jobs; employment is more widespread across New Zealand than for high technology manufacturing

Share of medium-high technology manufacturing employees vs share of all employees

% of employees; 2012

■ Share of medium-high technology manufacturing jobs □ Share of total jobs

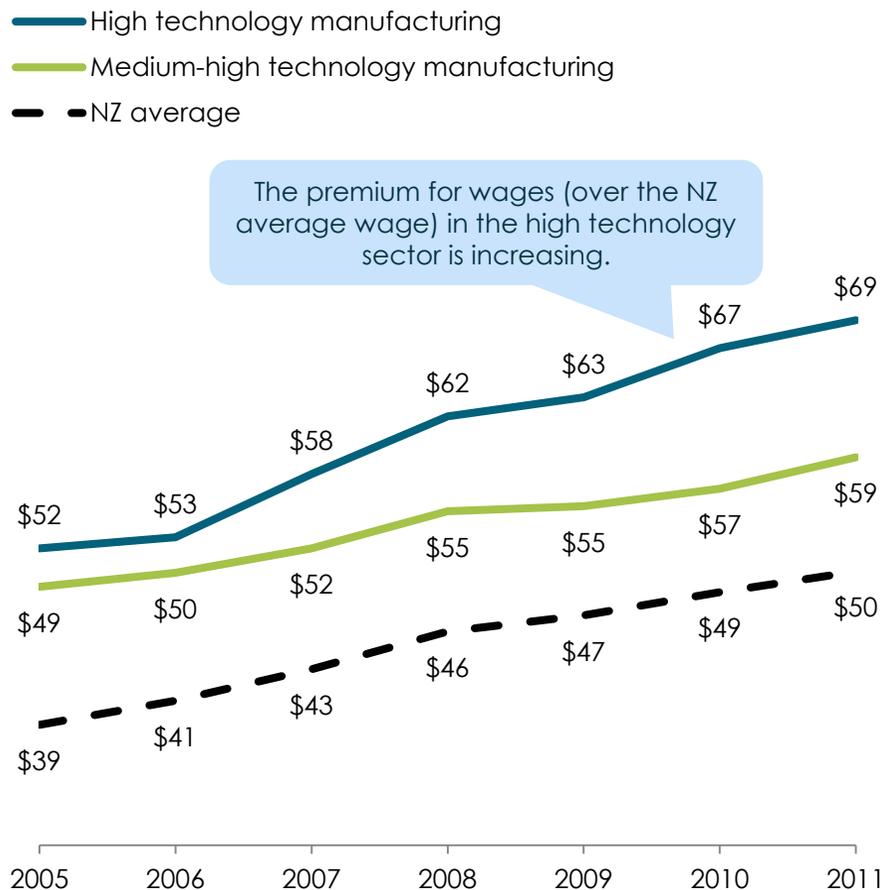


Salaries and wages paid

Workers in high technology manufacturing are paid over a third more than the New Zealand average, although wage growth has slowed since the GFC

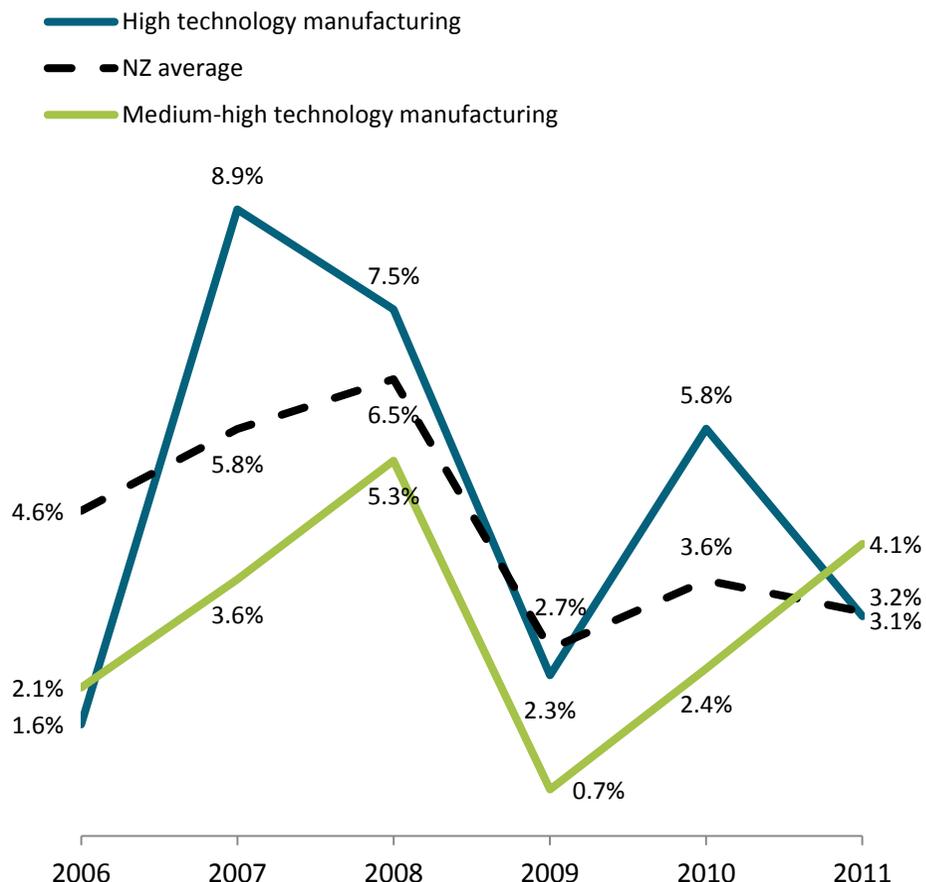
Average wages paid

NZ\$000; nominal prices; 2005–2011



Annual growth in the value of the average wage paid

% change; nominal; 2006–2011



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

Source: Statistics New Zealand, Annual Enterprise Survey



EXPORTS

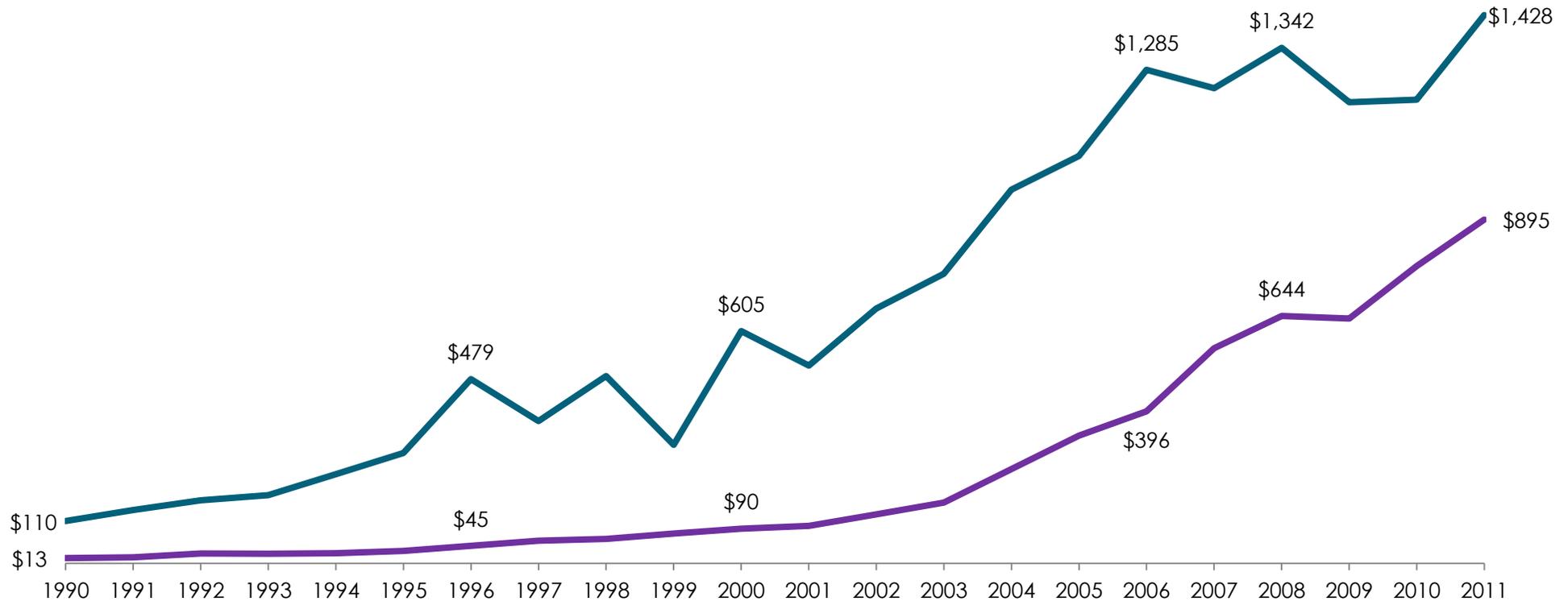
Long-term rise in export value

Like the wine industry, high technology manufacturing has developed from small beginnings to become a significant export earner

NZ exports of high technology manufactured goods and wine

US\$m; nominal; 1990–2012

— High Technology Manufacturing
— Wine



Note: data is taken from two different databases so should be treated as illustrative

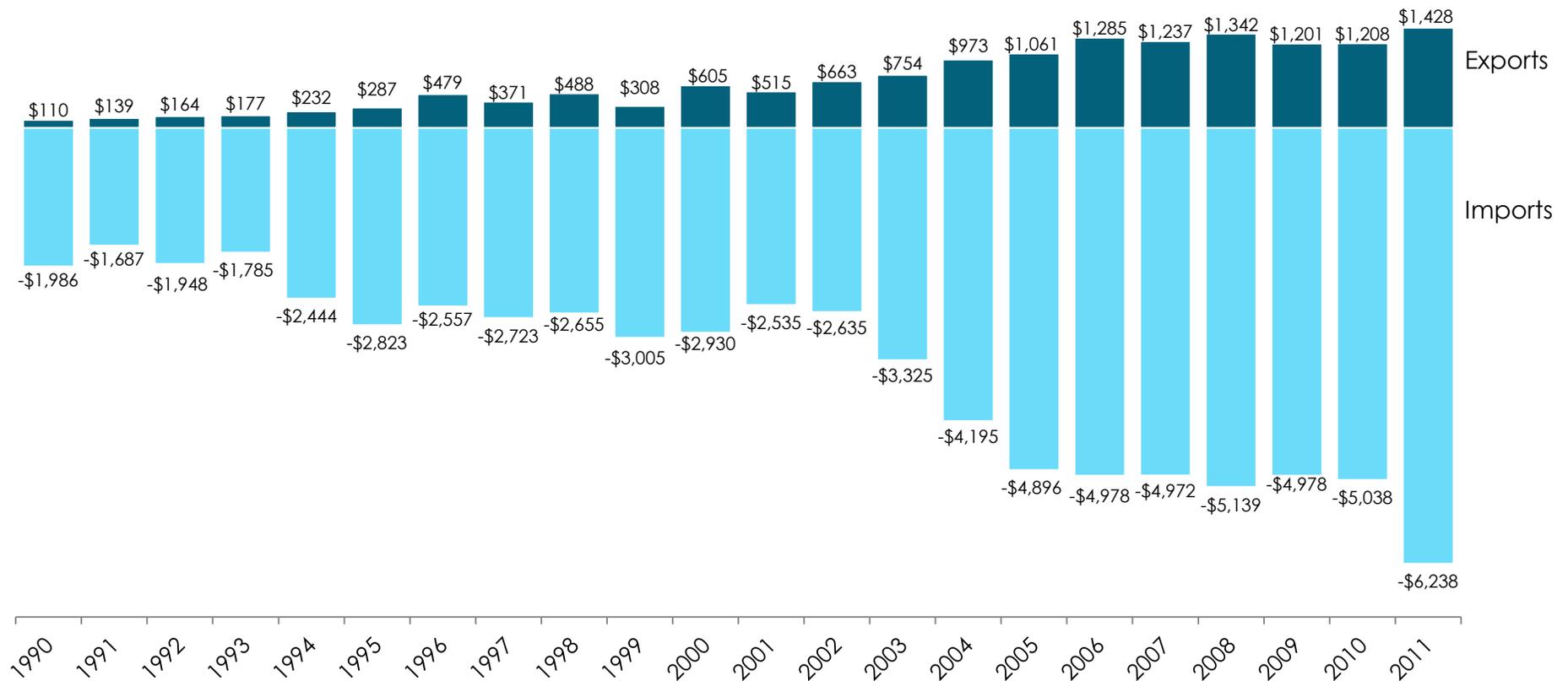
Source: OECD STAN Bilateral Trade Database (high technology manufacturing data) and COMTRADE database (wine data)

High technology manufacturing: exports vs imports

By value, New Zealand imports over four times more high technology goods than it exports

High technology manufacturing: exports vs imports

US\$m; nominal prices; 1990–2011

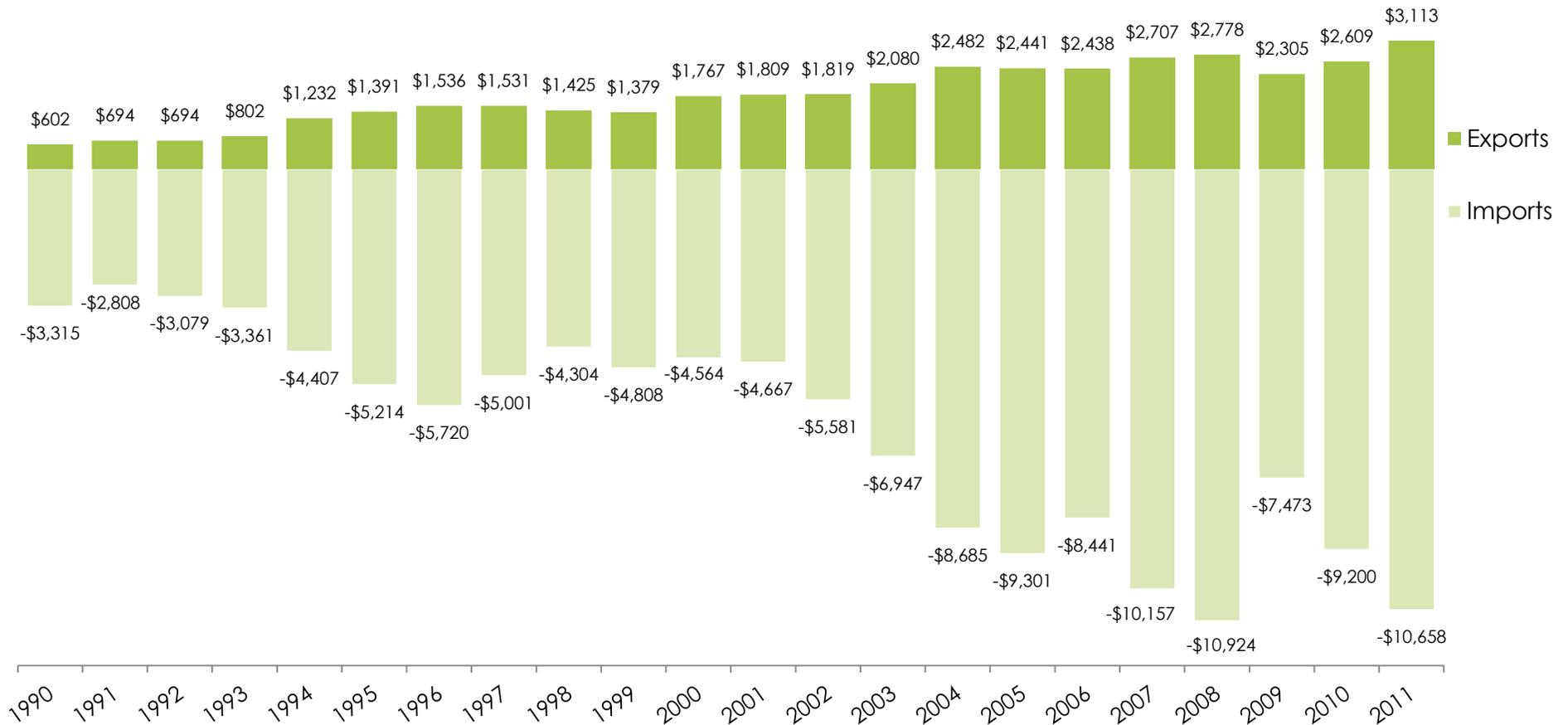


Medium-high technology manufacturing: exports vs imports

By value, New Zealand imports over three times more medium-high technology goods than it exports

Medium-high technology manufacturing: exports vs imports

US\$m; nominal prices; 1990–2011



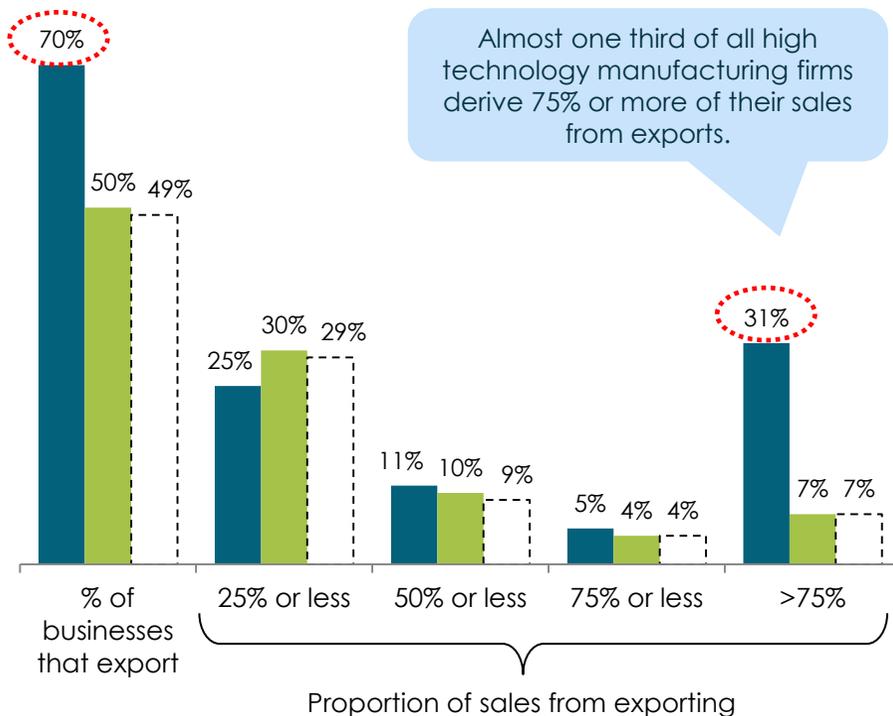
Export intensity: high technology vs medium-high technology manufacturing

70% of high technology firms export, deriving significant amounts of their revenue from overseas; medium-high technology firms are less export intensive

Number of firms reporting export sales

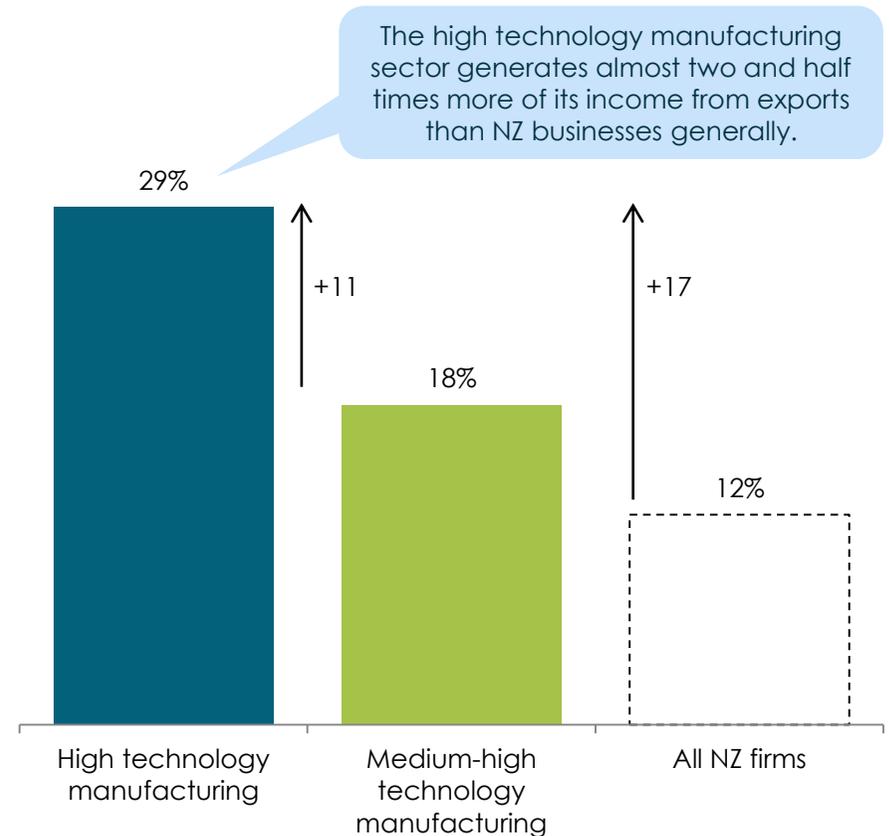
% of firms; 2012

- High technology manufacturing
- Medium-high technology manufacturing
- All manufacturing



% of income from exports

% of income; 2010

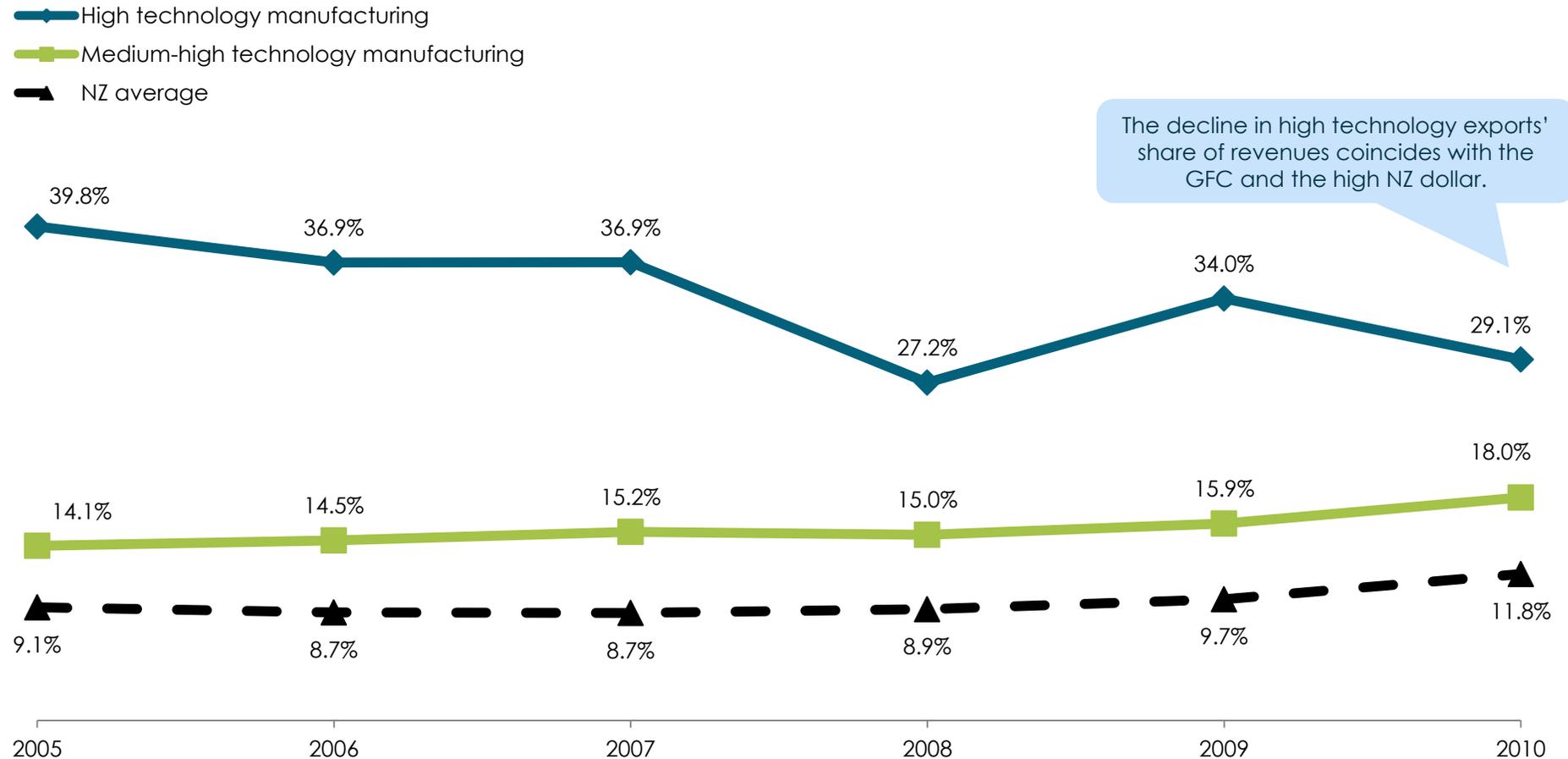


Share of income from exports: high technology vs medium-high technology manufacturing

In 2010, exports generated 29% of high technology revenues, down from 40% in 2005; and accounted for 18% of medium-high technology revenues, up from 14% in 2005

Exports as a % of total sector revenue

% of revenue; 2005–2010; nominal prices

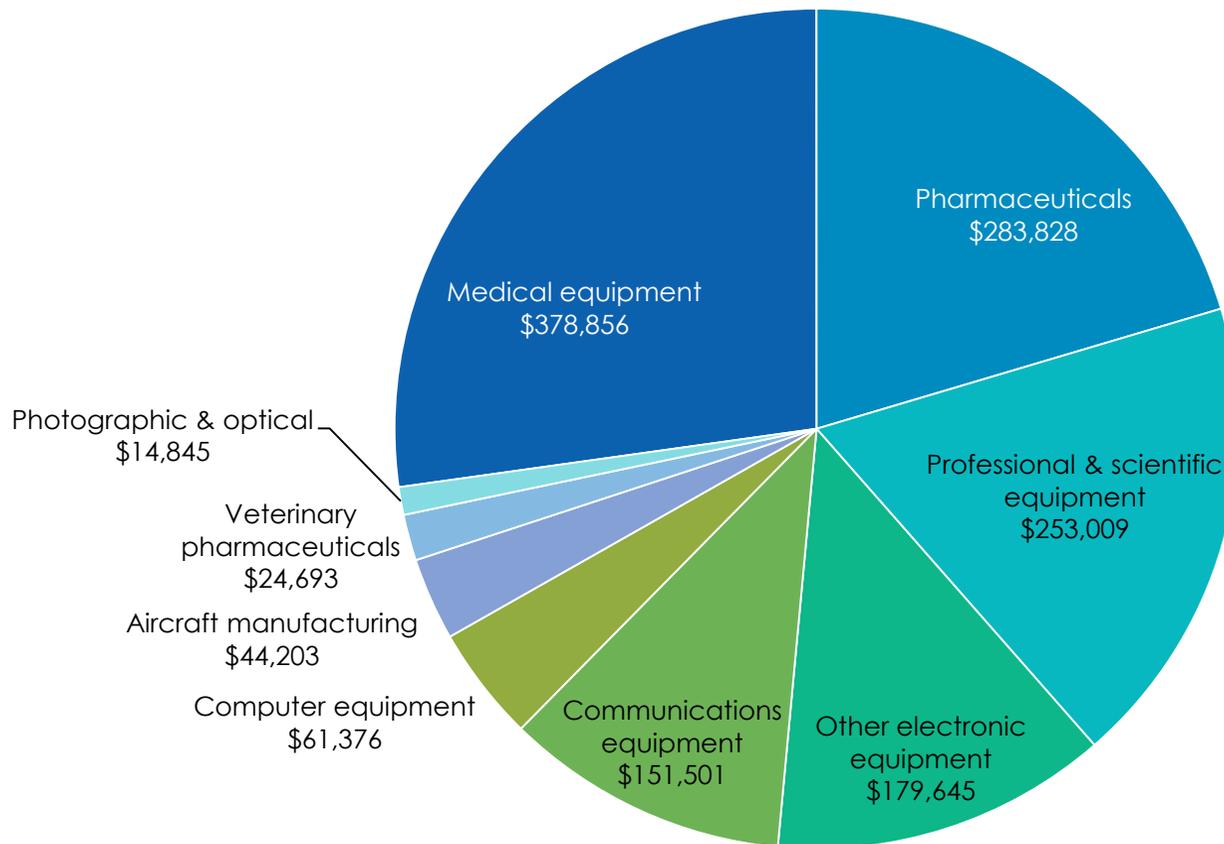


High technology manufacturing: exports by industry

Medical equipment is the high technology sector's largest export industry (\$379m), followed by pharmaceuticals (\$284m) and scientific equipment (\$253m)

Goods exports from high technology manufacturing industries

NZ\$000; 2012; year ended June; by sector (ANZSIC)



Total exports in 2012: NZ\$1.39b.

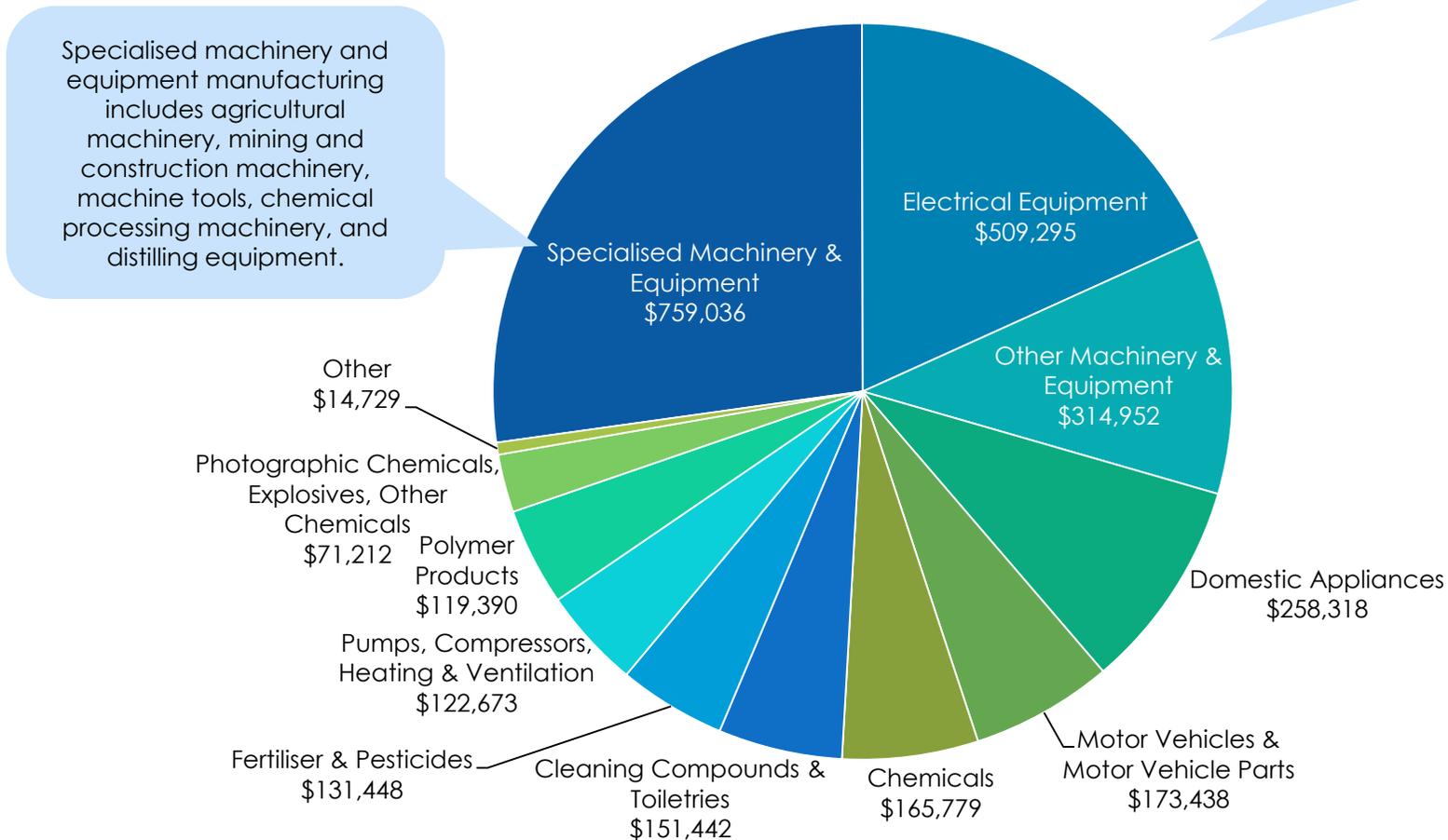
Medium-high technology manufacturing: exports by industry

Specialised machinery & equipment manufacturers (\$759m) and electrical equipment manufacturers (\$509m) generate almost half of the sector's export revenues (45%)

Goods exports from medium-high technology manufacturing industries

NZ\$000; 2012; year ended June; by sector (ANZSIC)

Total exports in 2012: NZ\$2.8b.

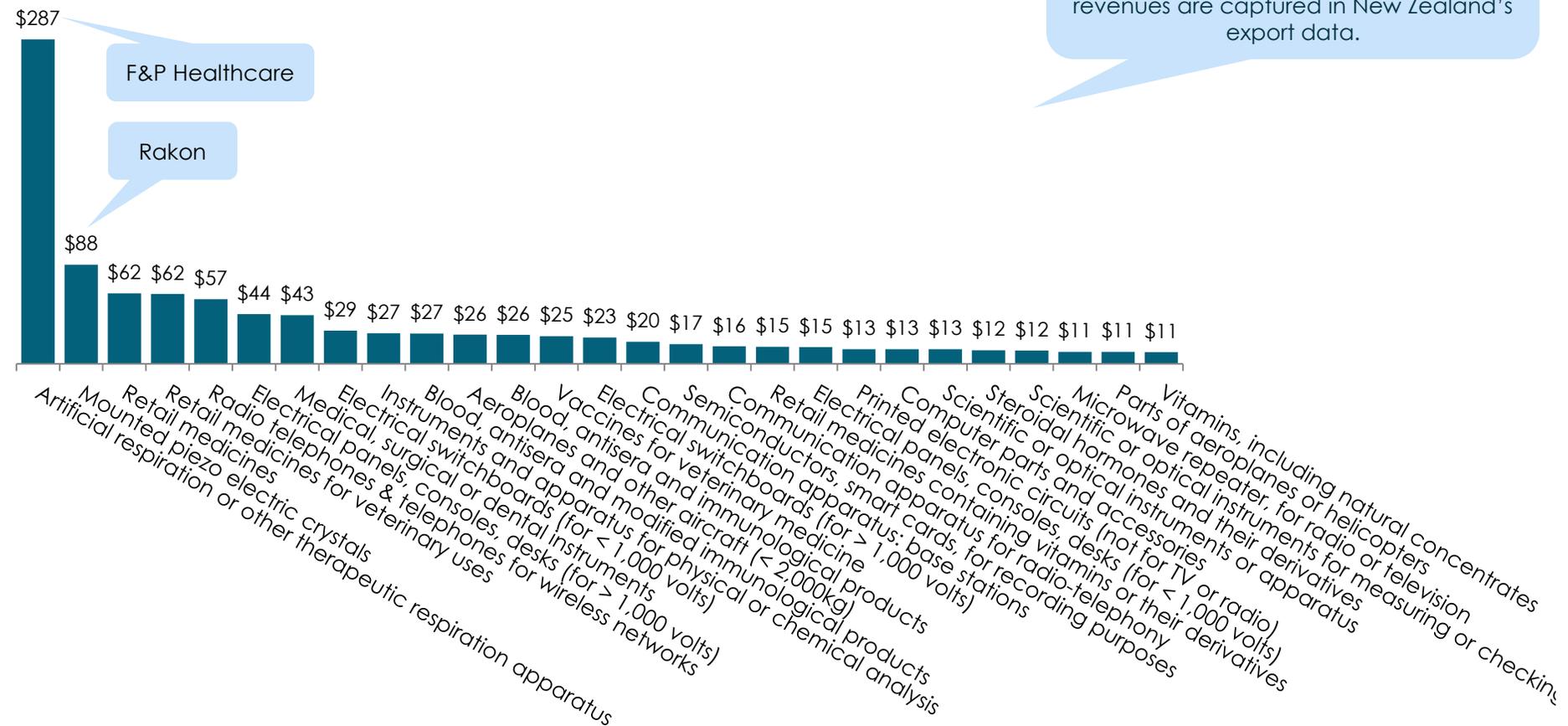


High technology manufacturing: leading export goods

Fisher & Paykel Healthcare, Rakon and NZ's pharmaceutical industry delivered the sector's three leading export goods in 2012

Export goods >\$10m in 2012

NZ\$m; year ended June 2012; HS10

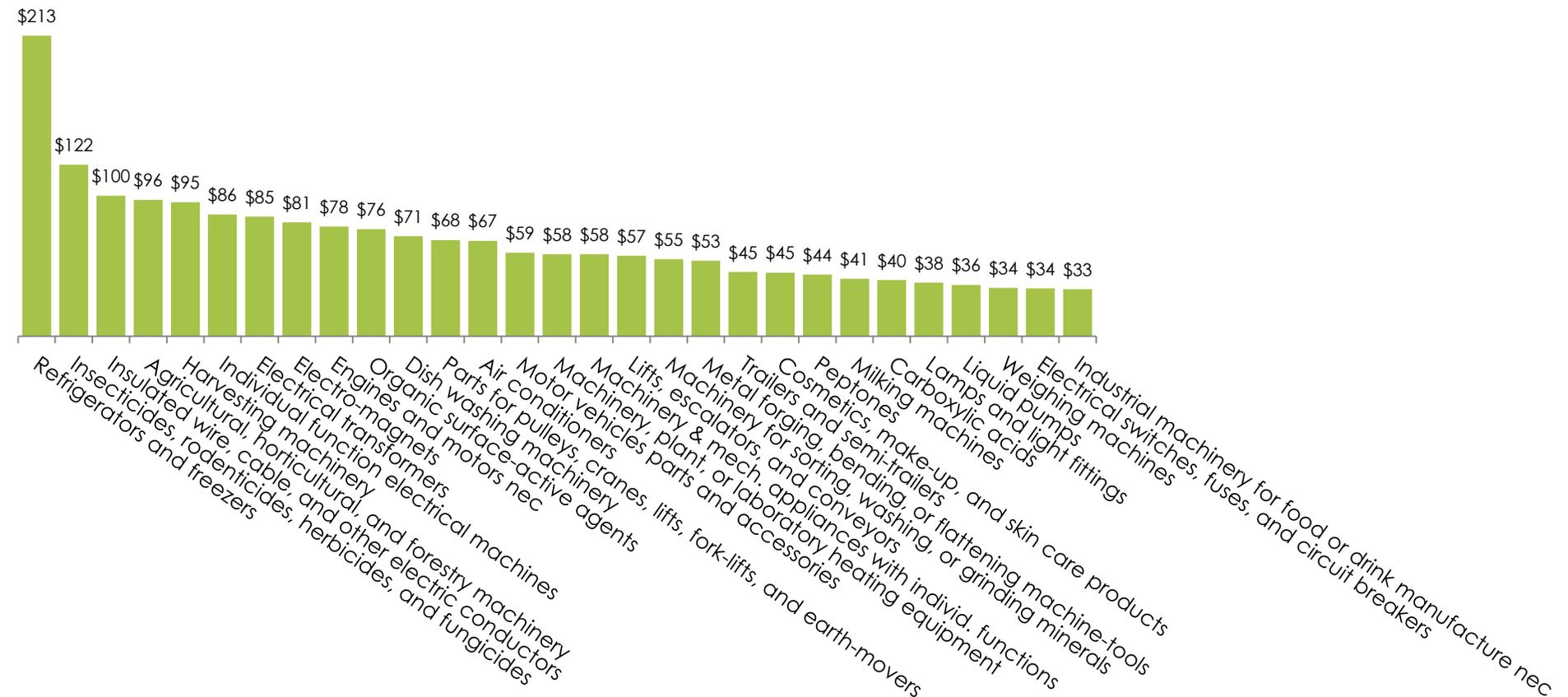


Medium-high technology manufacturing: leading export goods

The sector's leading exports reflect the significance of NZ's agricultural industries, alongside other strengths such as F&P Appliances' whiteware and Buckley Systems' electro-magnets

Export goods >\$30m in 2012

NZ\$m; year ended June 2012; HS4



Export performance: industry comment

Comments pointed to the sector's small scale and distance from major markets; however dominance by a few large firms is common in small economies

- *We are really relying on a few very large and successful businesses that dominate the sector – the likes of the F&P Healthcares, the Gallaghers and Tait's of the world. There is not a heck of a lot going on below that.*
 - CEO, med-high technology firm
- *When you compare Denmark and New Zealand in pharmaceuticals, we both have a handful of companies of any size. Its just ours (Douglas, NZP) are in the hundred millions and theirs are in the billions (NovoNordisk, Lundbeck, Leo). All small countries are like this - a few companies at scale dominate the export sector. Denmark exports a lot more toys than New Zealand; its not 100 companies, its just Lego.*
 - Partner, market research firm
- *Manufacturing from New Zealand is not trivial. It is tough, because we don't slot well into global value chains. The remoteness really is a problem for that.*
 - CEO of small high technology firm
- *Remoteness and the small size explains lack of depth in our capital markets. It explains an industry structure which prevents people from getting to scale. We all know that it takes companies of scale to really evolve in serious R&D and serious exporting. We don't have those companies that get there. ...Do I think that it prevents us from actually ever having a company that gets to scale in a global niche? Absolutely not. There are opportunities out there that would blow your socks off that we could really create significant businesses based in New Zealand. But it's not easy to push them through.*
 - Venture capitalist
- *When you go to internationalise, some core elements need to be closer to the market that you're targeting. And those core elements have to go off-shore to some extent. So you start with a hiss and roar, but then you go backwards a wee bit. But if you continue to succeed, you pick up again. And I suspect some of that lies behind the [export] numbers. The innovation and R&D will still be here, but manufacturing at scale will mostly need to be done in a lower cost location. These are still valuable New Zealand companies at that point.*
 - Director, technology firm

High technology manufacturing: export values

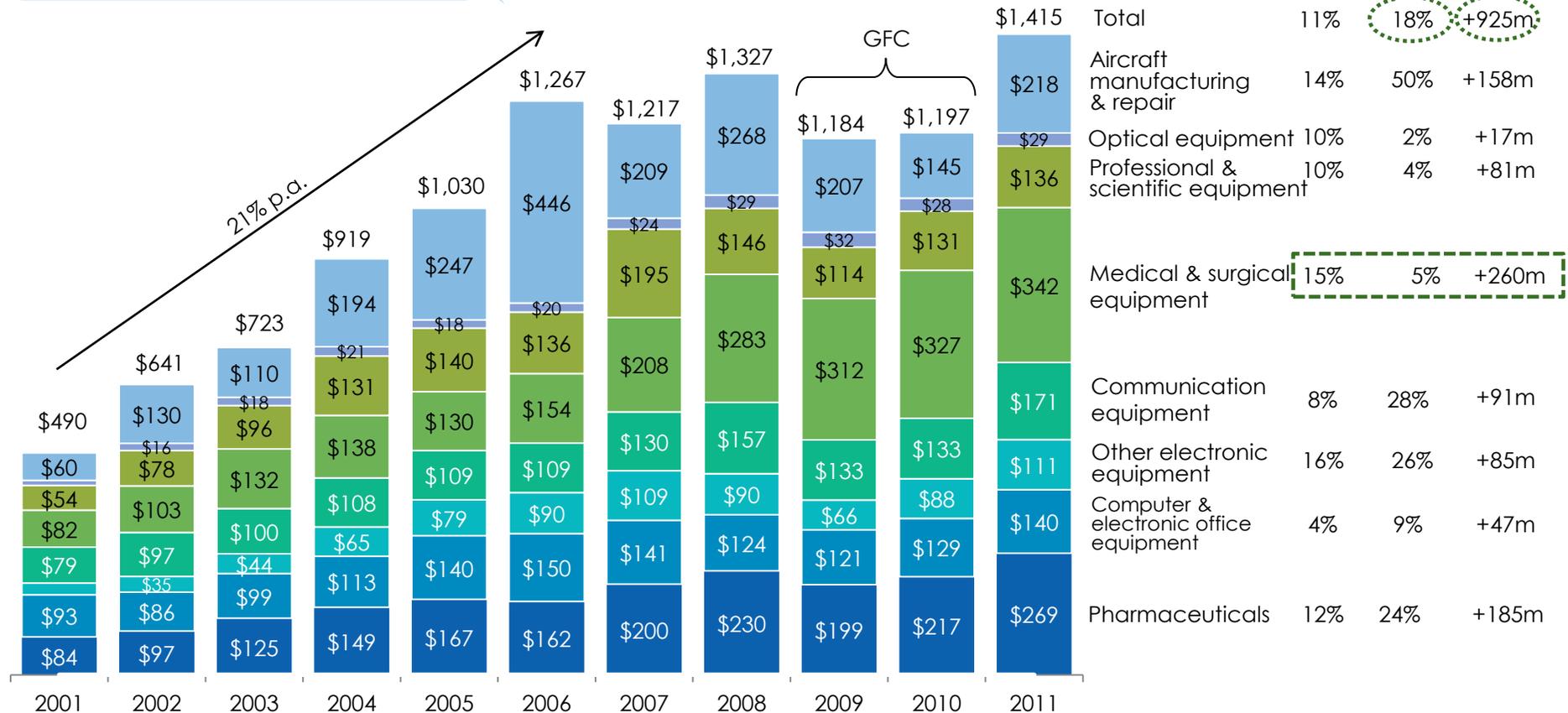
In nominal US dollars, the export value of high technology manufacturing goods grew by 21% per year from 2001 to 2006, but has only averaged 2.2% per year since

Export value of high technology manufacturing goods

US\$m; nominal prices; 2001–2011; by subsector

Note that export growth slowed from 2006, well before the onset of the GFC.

Exports have grown significantly faster than numbers of firms, indicating that export growth has been driven by existing firms.



Source: OECD ITCS Database. CAGR = compound annual growth rate.

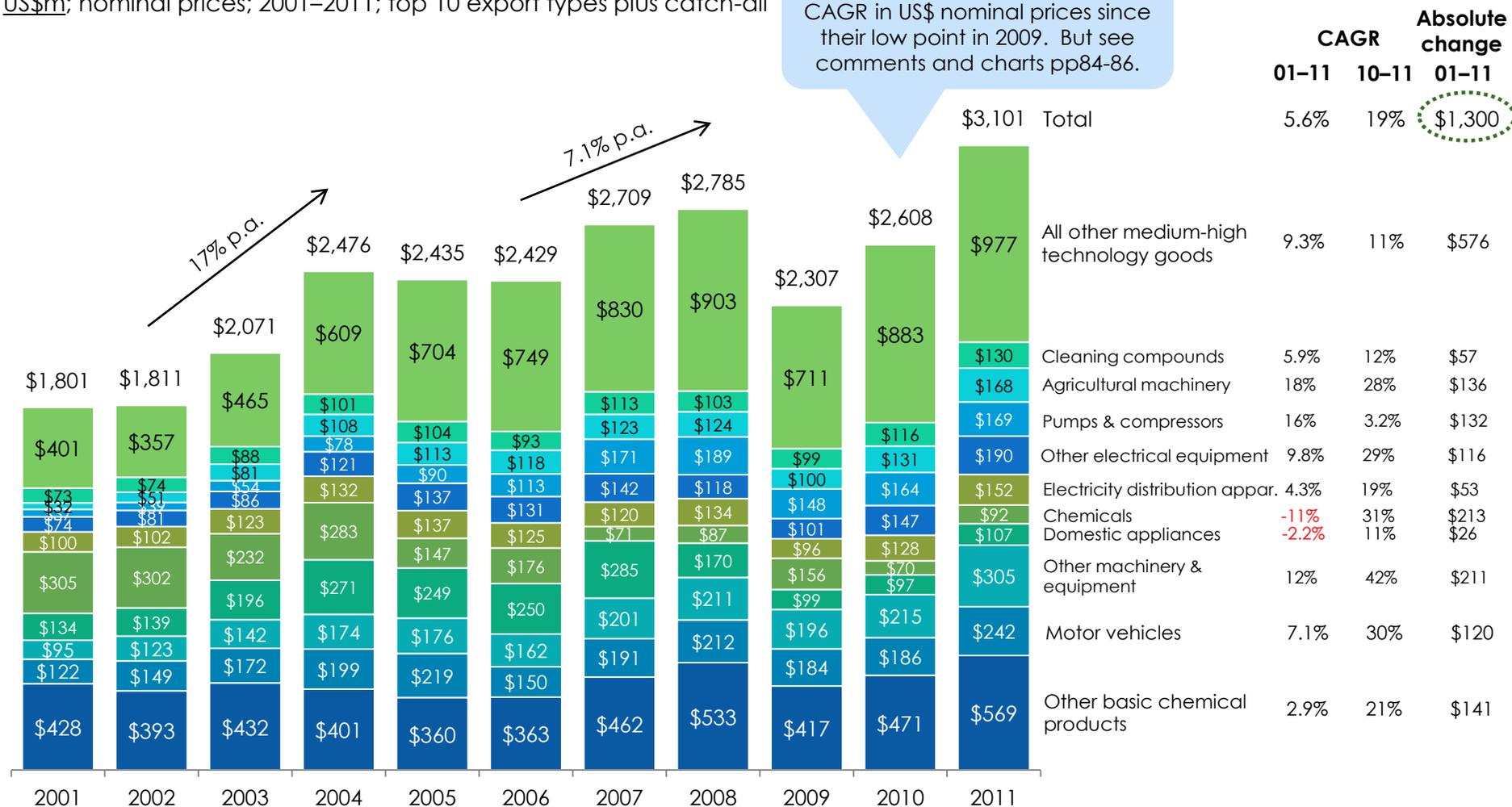
Medium-high technology manufacturing: export values

In nominal US dollars, the export value of medium-high technology manufacturing goods has grown by US\$1.3b over the last decade (5.6% p.a.)

Export value of medium-high technology manufacturing goods

US\$m; nominal prices; 2001–2011; top 10 export types plus catch-all

Exports have grown at 16% CAGR in US\$ nominal prices since their low point in 2009. But see comments and charts pp84-86.



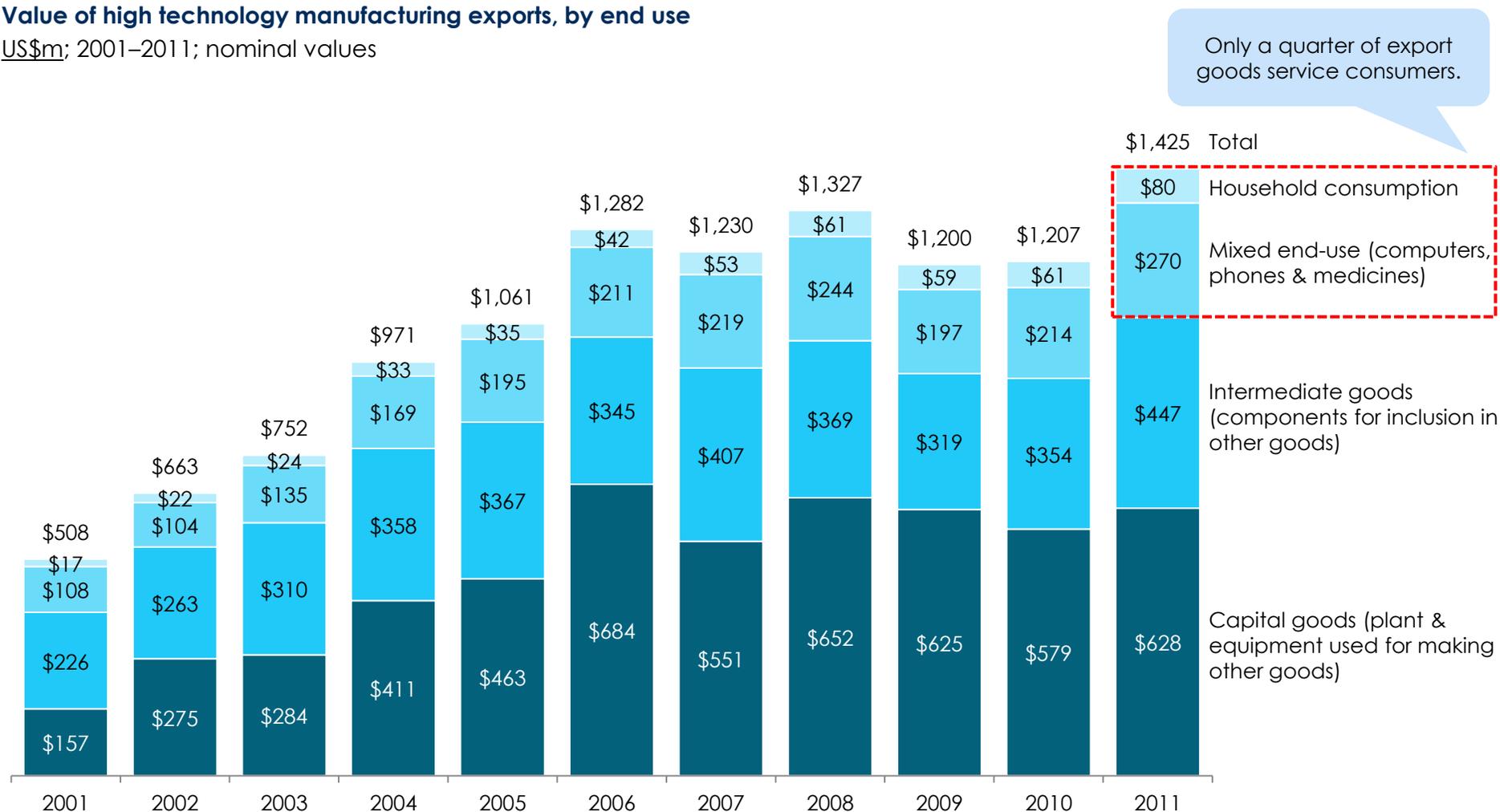
Source: OECD ITCS Database. CAGR = compound annual growth rate.

High technology manufacturing: end use of exports

The majority of high technology goods exports are components in the manufacture of other products, or the machines used to manufacture other products

Value of high technology manufacturing exports, by end use

US\$m; 2001–2011; nominal values

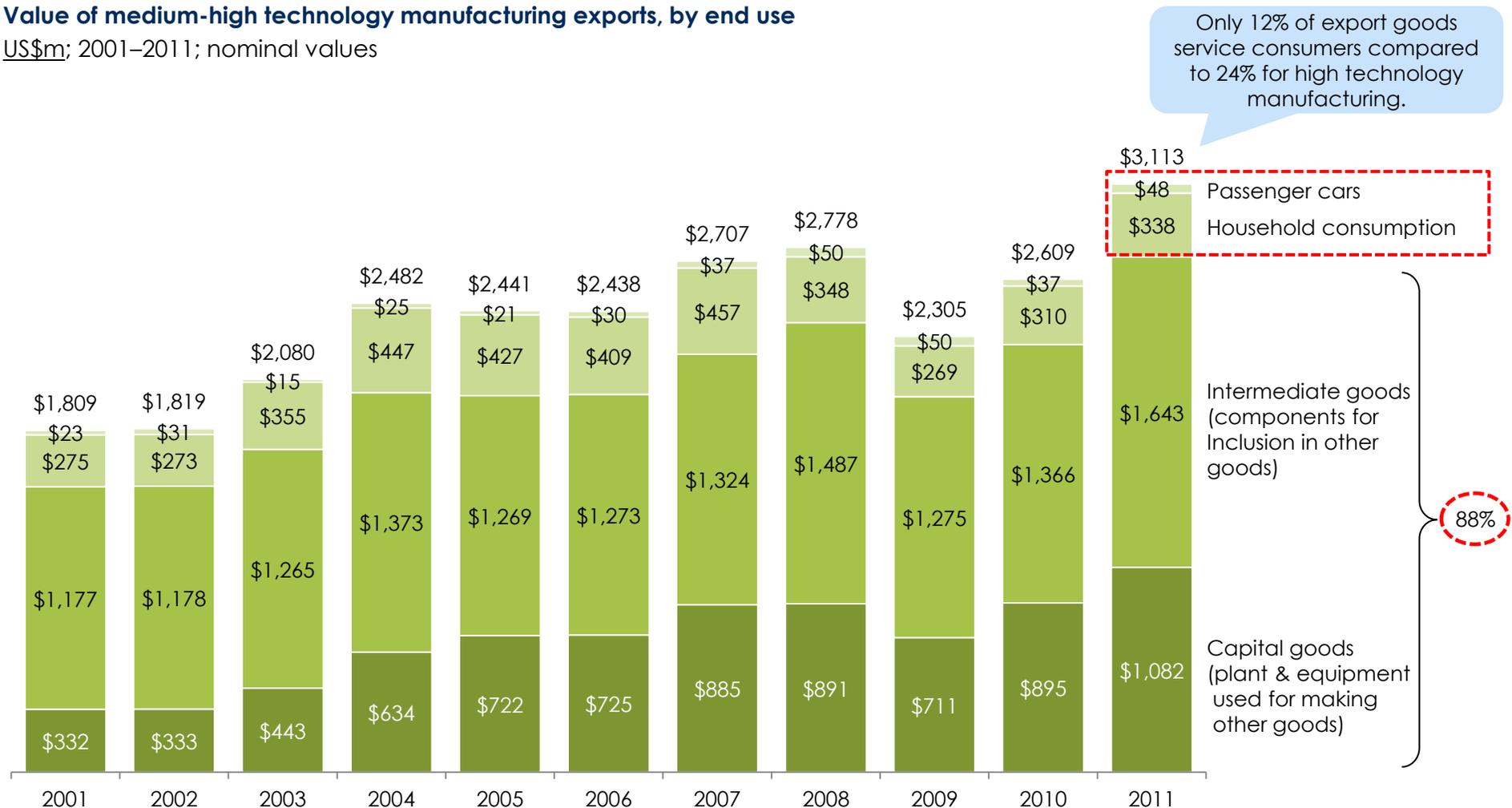


Medium-high technology manufacturing: end use of exports

Intermediate and capital goods make up 88% of medium-high technology exports

Value of medium-high technology manufacturing exports, by end use

US\$m; 2001–2011; nominal values

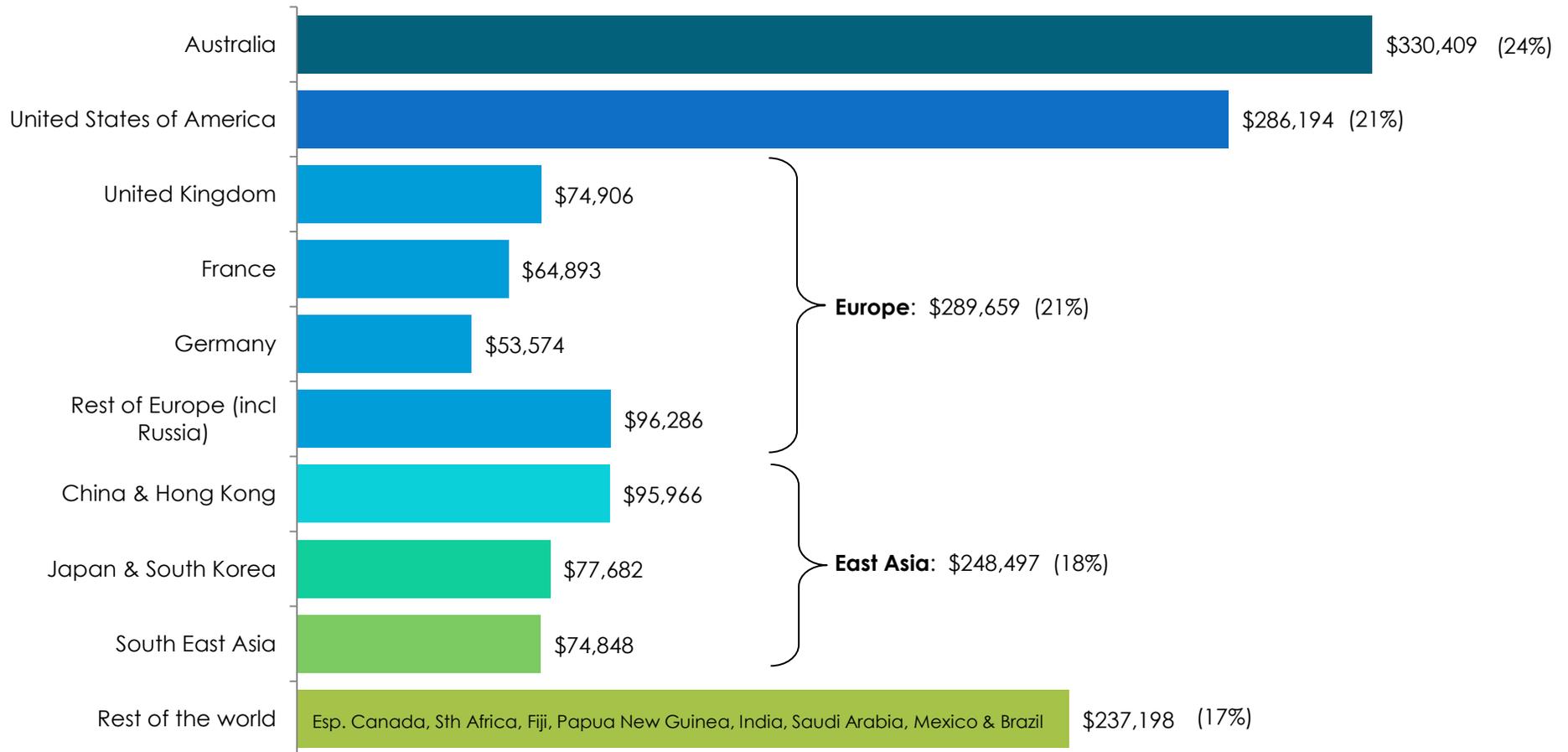


High technology manufacturing: export destinations

High technology manufacturers are succeeding in mature and demanding markets, with Australia, the US and Europe taking two-thirds of exports

Export value of high technology manufacturing goods, by destination

NZ\$000; year ended June 2012

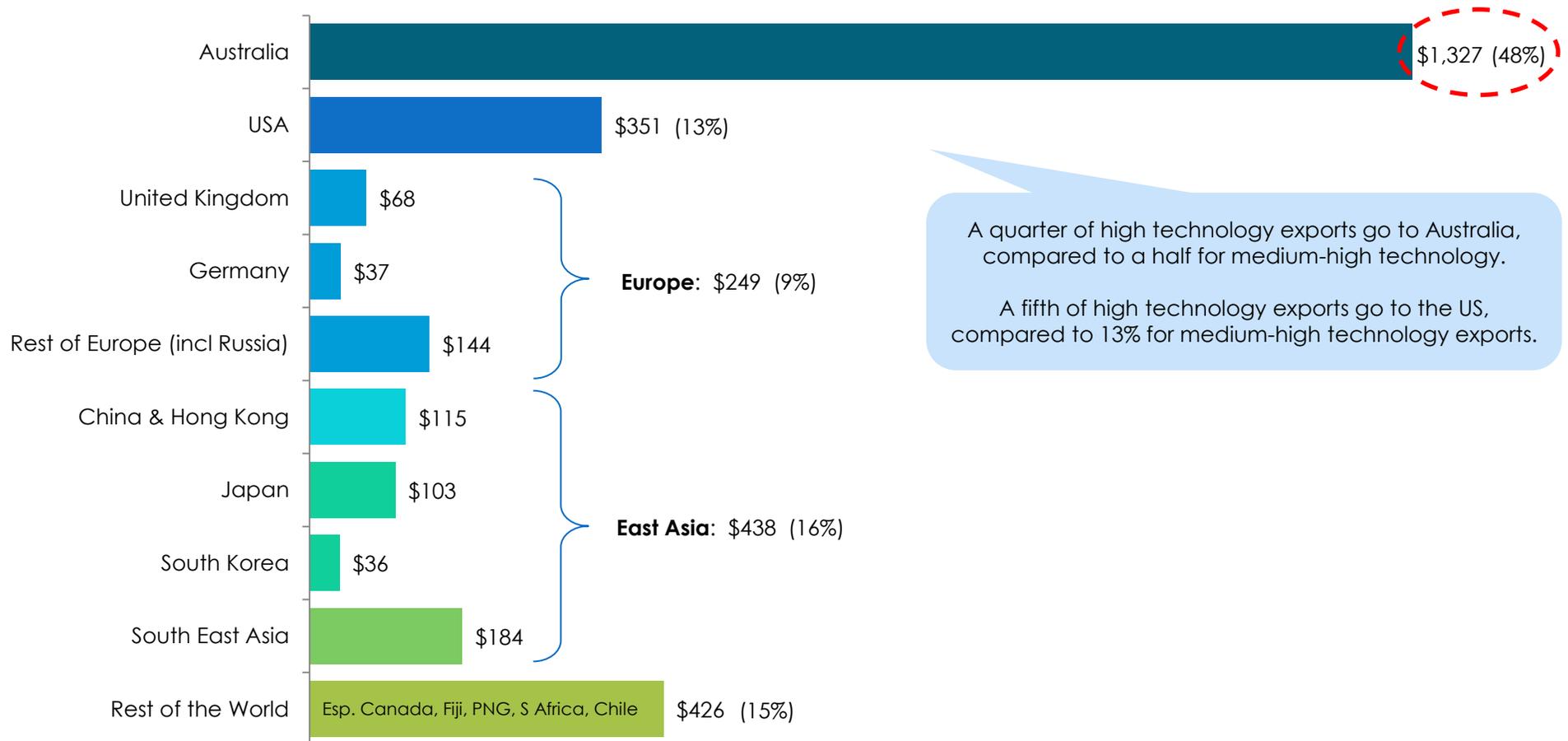


Medium-high technology manufacturing: export destinations

Close to half (48%) of New Zealand's medium-high technology goods exports go to Australia, worth NZ\$1.3b last year

Export value of medium-high technology manufacturing goods, by destination

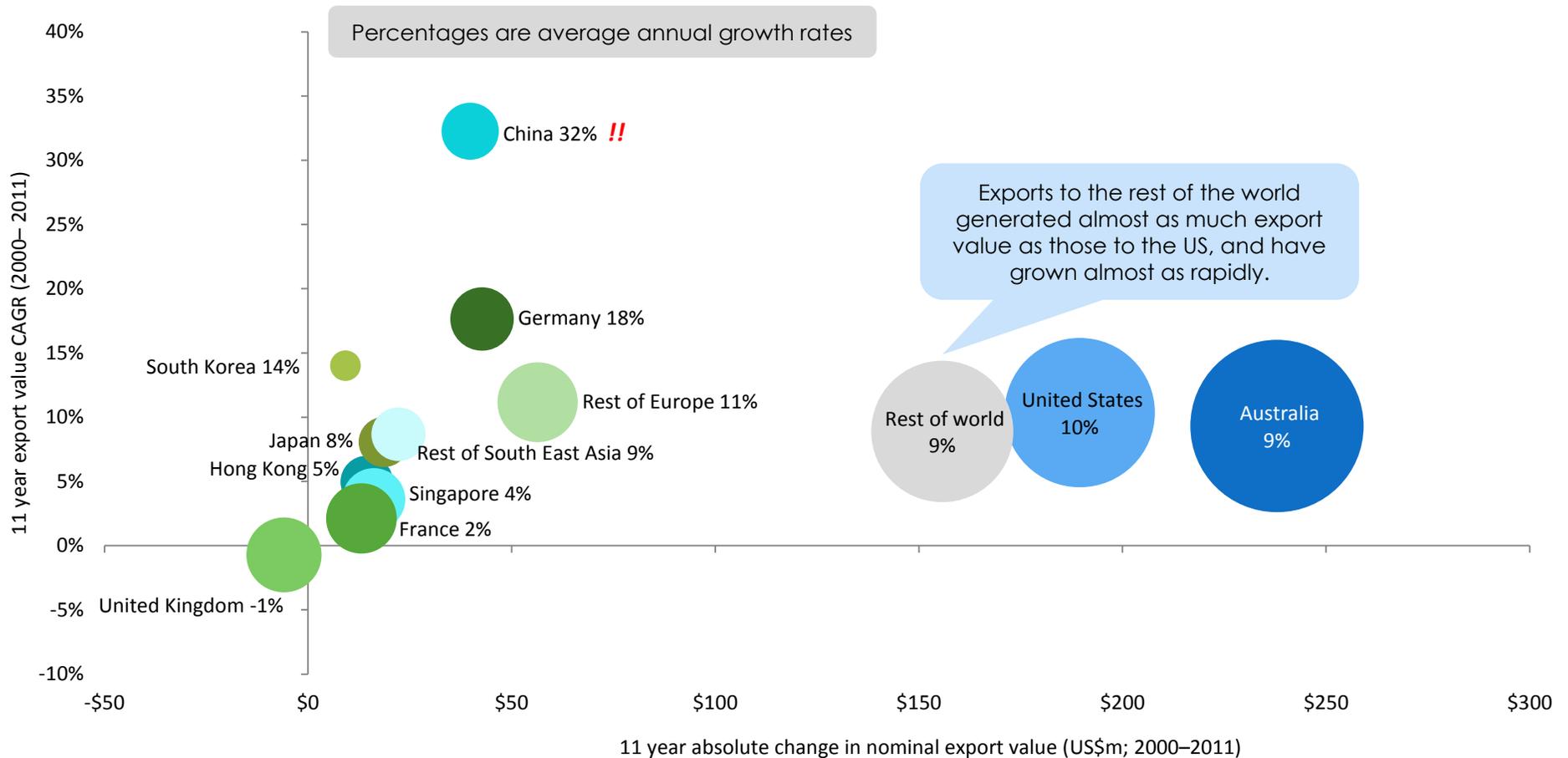
NZ\$m; year ended June 2012



High technology manufacturing: export growth by destination

Export growth in high technology manufacturing has been driven by large, traditional markets; the markets in Asia have grown more slowly, except for China and South Korea

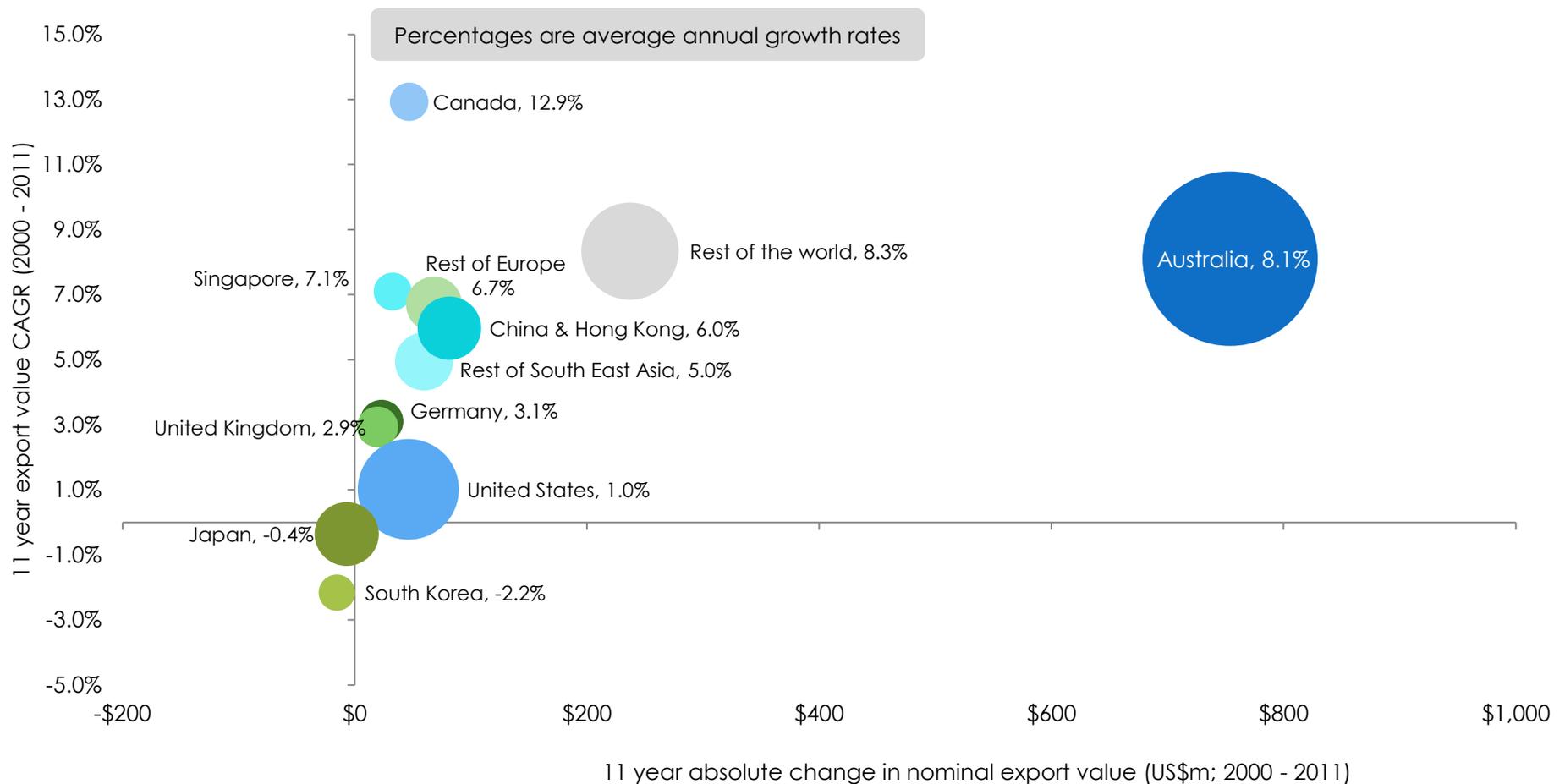
Matrix: 11 year absolute growth (x-axis) **vs 11 year compound annual growth rate** (y-axis) **vs Export value in 2011** (bubble size)
US\$m; nominal growth; 2000–2011



Medium-high technology manufacturing: export growth by destination

Australia dominates medium-high technology exports, both in size (US\$1.3b) and nominal growth over the last decade (US\$754m, 8.1% p.a.)

Matrix: 11 year absolute growth (x-axis) **vs 11 year compound annual growth rate** (y-axis) **vs export value in 2011** (bubble size)
US\$m; nominal growth; 2000–2011

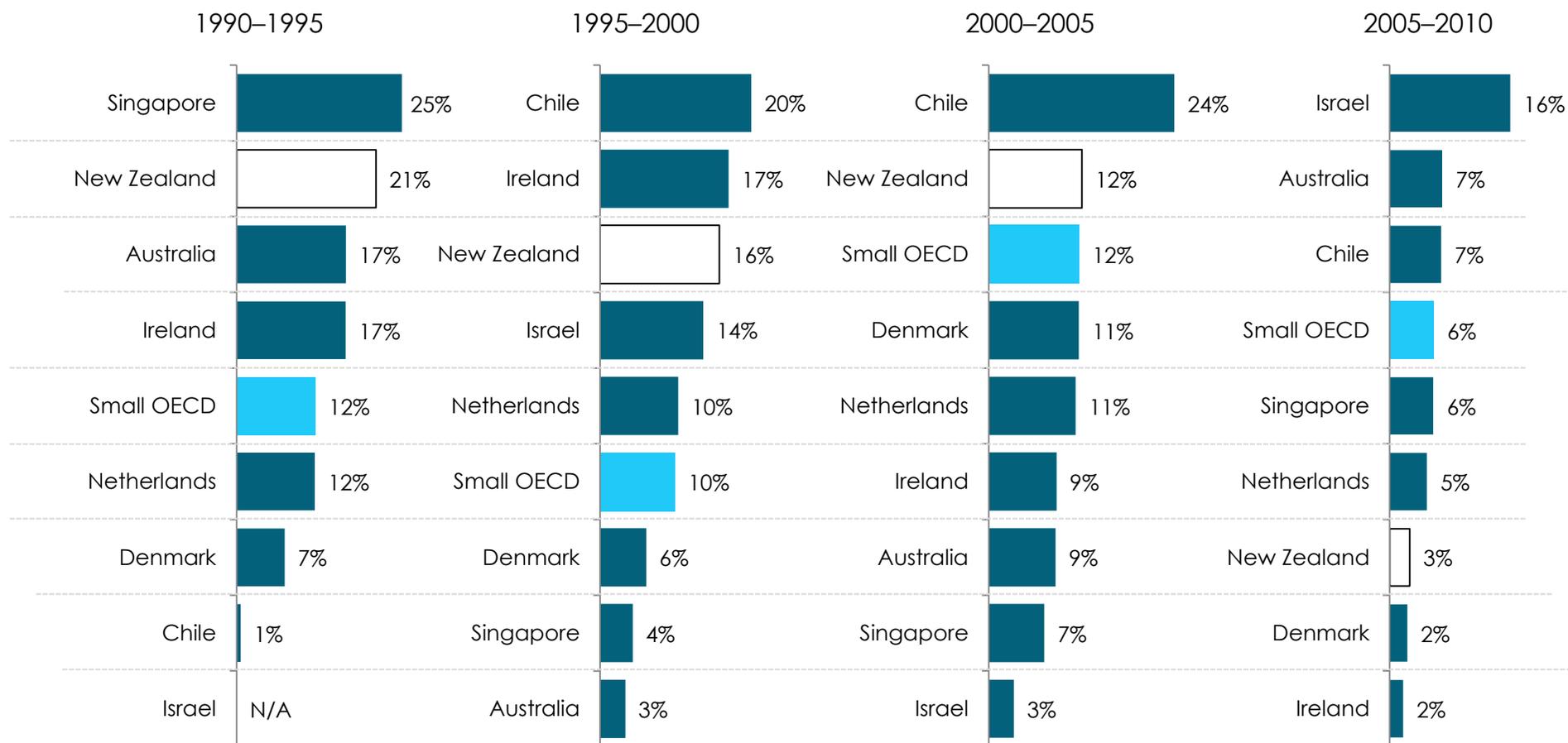


High technology manufacturing: export performance

The rate of growth in the export value of high technology manufacturing goods has declined over the last 20 years, but compares well with peers

5 year growth rate in the total export value of high technology manufacturing goods: New Zealand vs selected peers

%; nominal growth in US\$; 1990–2010



Note: Small OECD = the 19 other OECD countries with fewer than 20m people

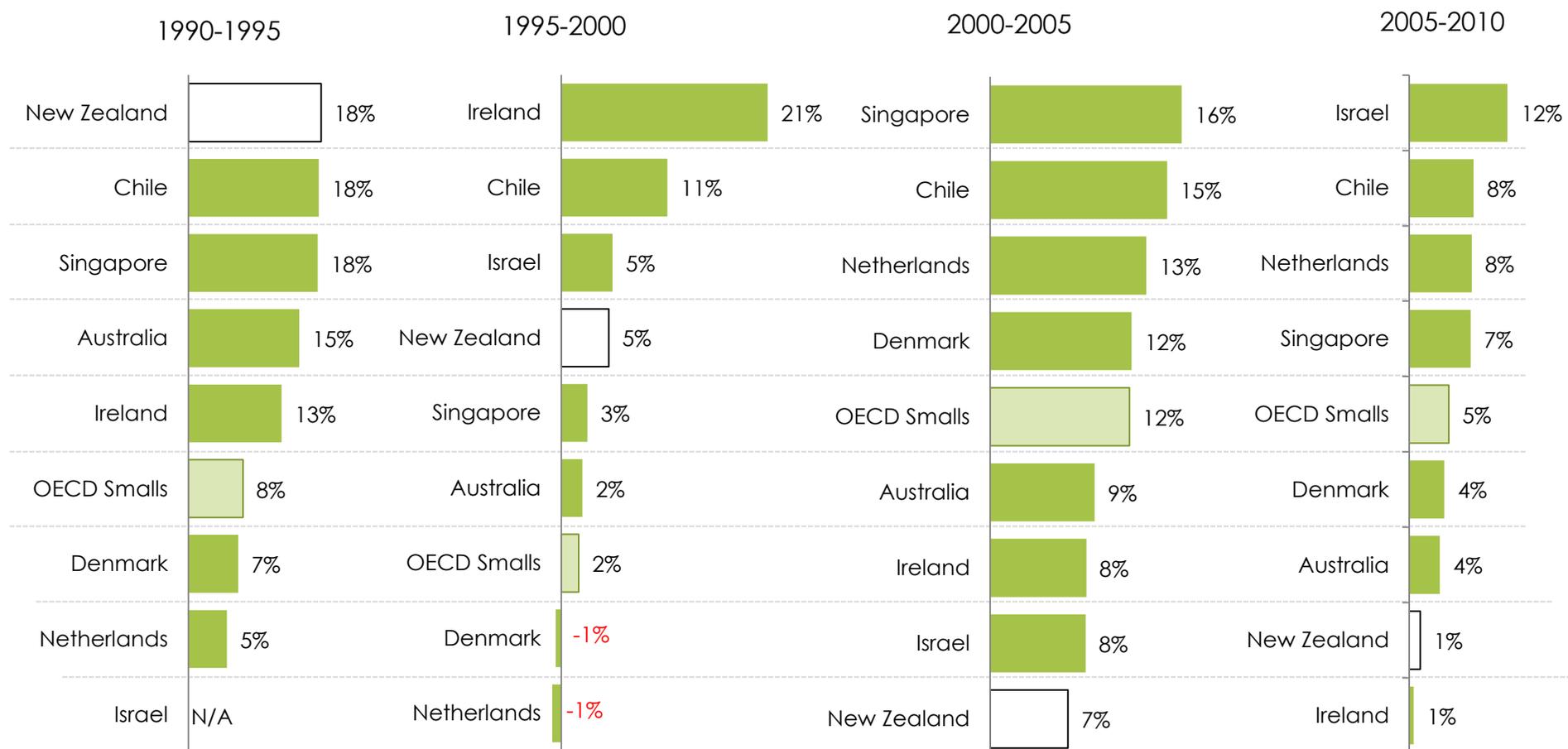
Source: OECD STAN Bilateral Trade Database

Medium-high technology manufacturing: export performance

In the 1990s, the export value of medium-high technology goods grew over twice as fast as the average for comparable countries; in the 2000s, export values grew half as fast

5 year growth rate in the total export value of medium-high technology manufacturing goods: New Zealand vs selected peers

%; nominal growth in US\$; 1990–2010



Note: OECD Smalls = the 19 other OECD countries with fewer than 20m people

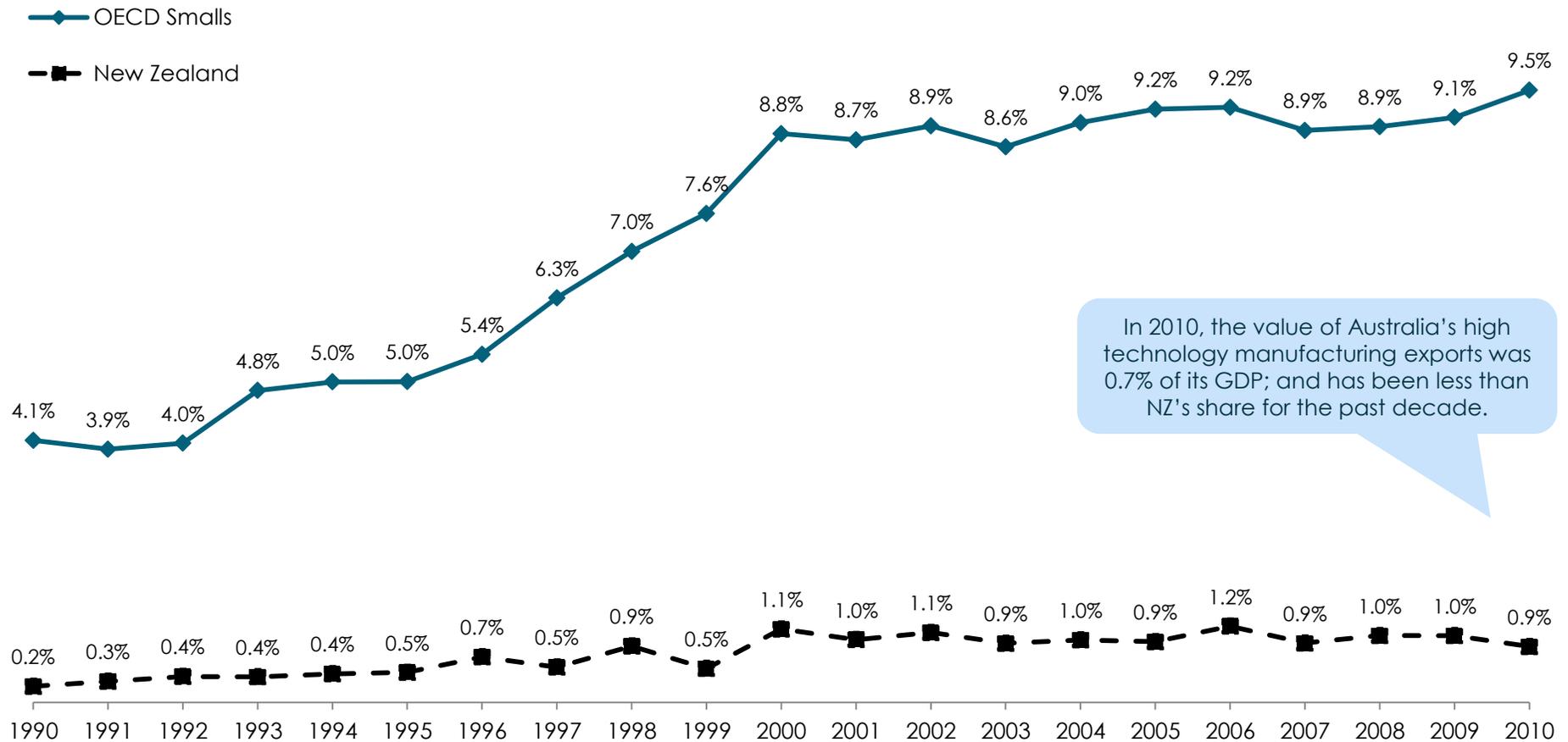
Source: OECD STAN Bilateral Trade Database

High technology manufacturing: exports relative to GDP

When compared with other small developed countries, the value of New Zealand's high technology manufacturing exports is low as a share of our GDP

Value of high technology manufacturing exports as a share of GDP

%; 1990–2010; NZ compared with the 19 other OECD countries with fewer than 20m people (aggregated)



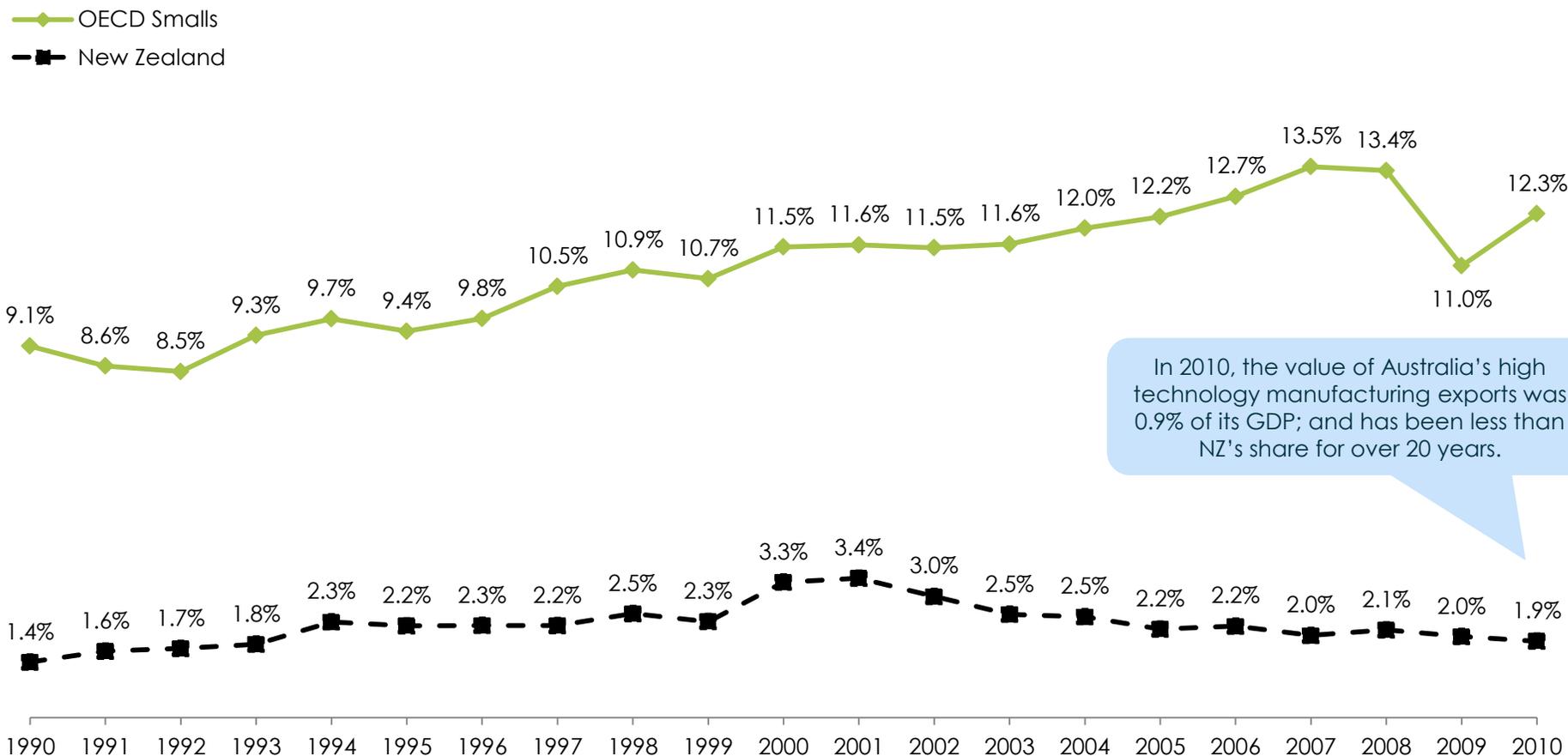
In 2010, the value of Australia's high technology manufacturing exports was 0.7% of its GDP; and has been less than NZ's share for the past decade.

Medium-high technology manufacturing: exports relative to GDP

When compared with other small developed countries, the value of New Zealand's medium-high technology manufacturing exports is low as a share of our GDP

Value of medium-high technology manufacturing exports as a share of GDP

%; 1990–2010; NZ compared with the 19 other OECD countries with fewer than 20m people (aggregated)



High technology manufacturing: index of employment and export growth

Employment and export growth both slowed from 2006, coinciding with, first, a high exchange rate and, later, the global financial crisis

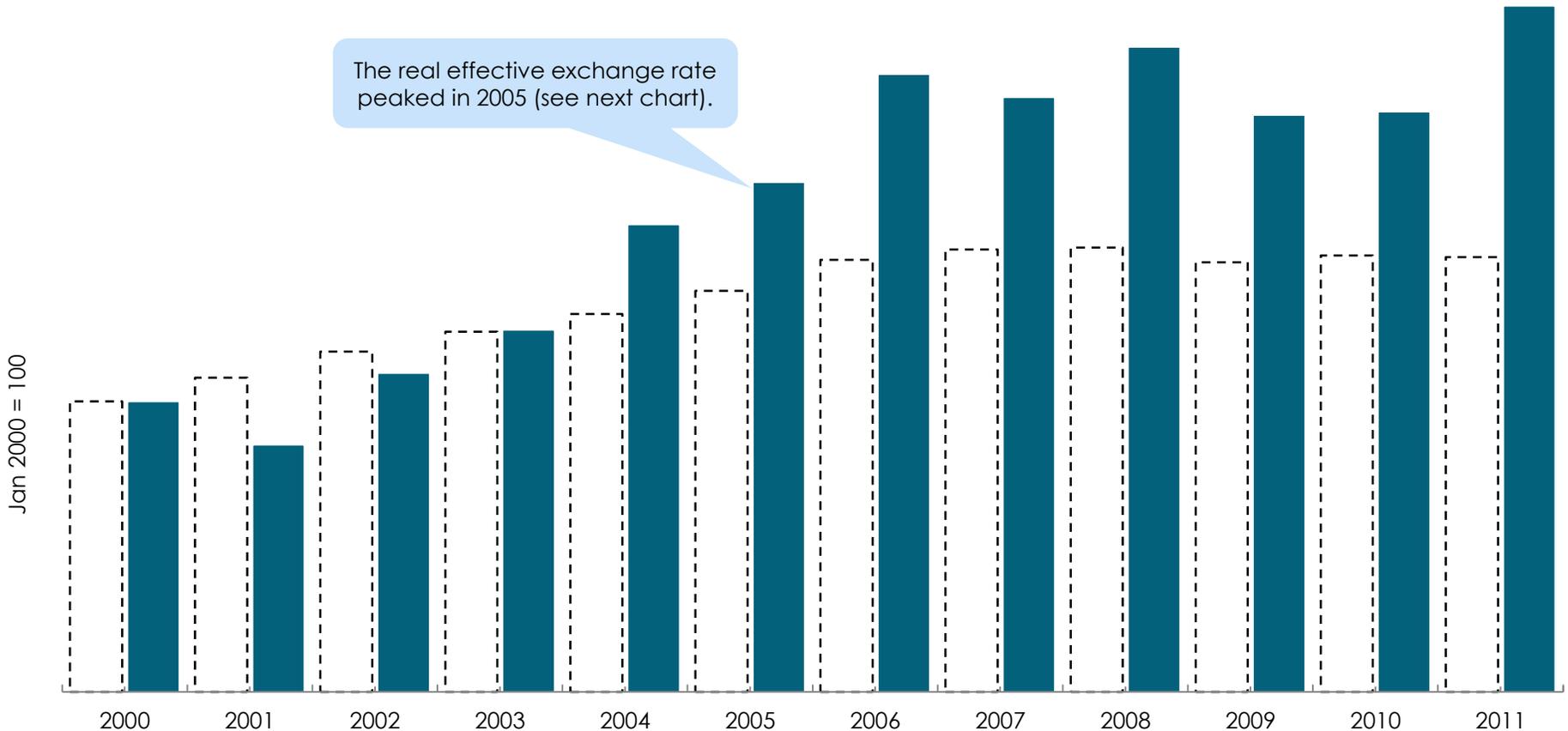
Exchange rate vs employees and export values

2000–2011 index; nominal export values in US\$

■ Value of export goods - - - - - Number of employees in sector

An increase in the use of offshore manufacturing facilities may also help to explain the decline in job and export growth from 2006.

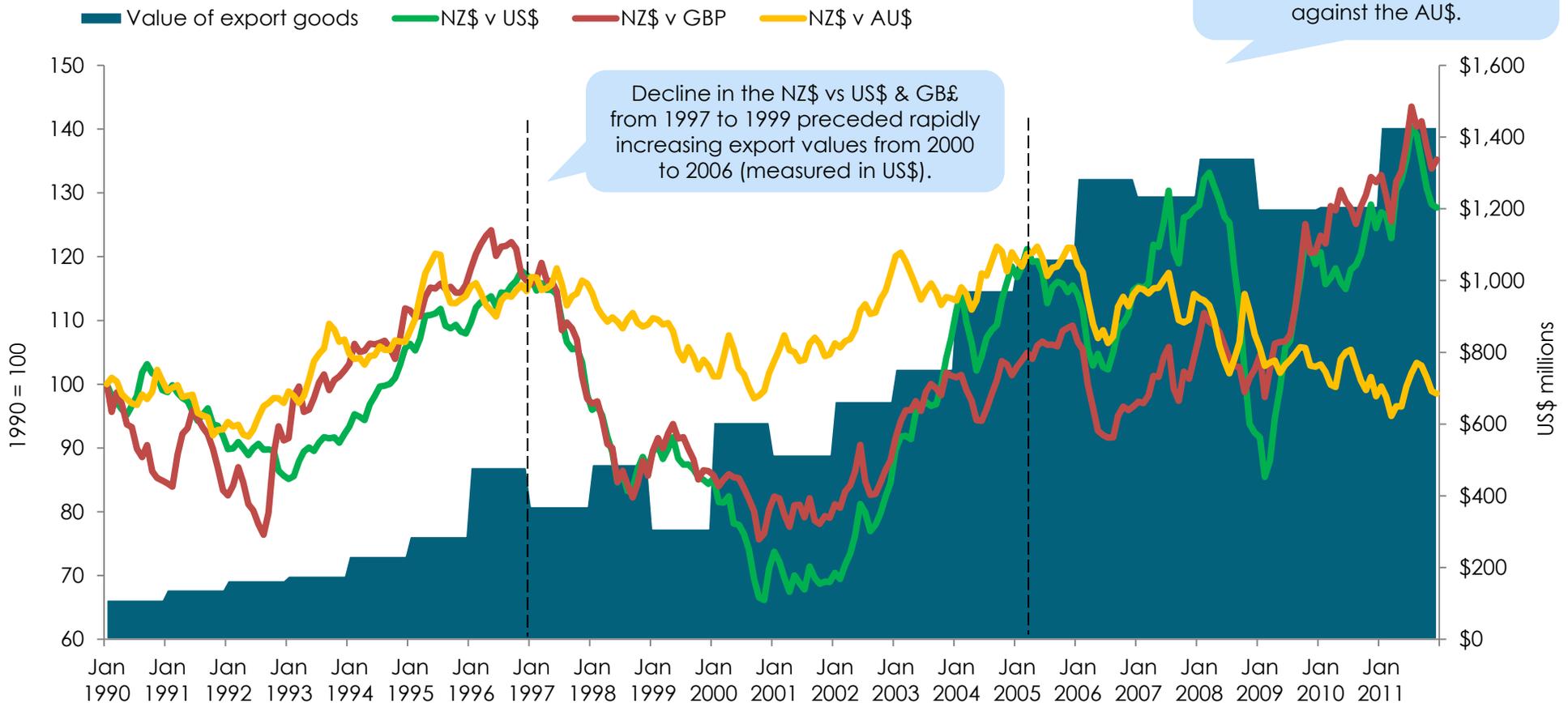
The real effective exchange rate peaked in 2005 (see next chart).



High technology manufacturing: exchange rate

Slowing export growth in the mid-2000s coincided with the highest dollar in 10 years against the sector's two biggest trading partners

Monthly exchange rate index¹ (left hand side) **and Value of export goods in US\$** (right hand side) 1990–2011; Left side: Jan 1990 = 100; Right side: US\$m; nominal export values



1. NZ dollar versus the currencies of the sector's main trading partners

Source: Reserve Bank of New Zealand (exchange rates); OECD STAN Bilateral Trade Database (export values)

High technology manufacturing: effect of the exchange rate on export values

The nominal value of high technology exports in US dollars has more than doubled in the last decade, whereas the value of the same* goods in NZ dollars has grown by only 30%

Index of export value: NZ\$ vs US\$

2002=100; nominal; total value of the goods exported by the high technology manufacturing sector



Source: US\$ values: OECD STAN Bilateral Trade Database; NZ\$ values: Statistics NZ, Merchandise Exports (MBIE concordance HS to ANZSIC)

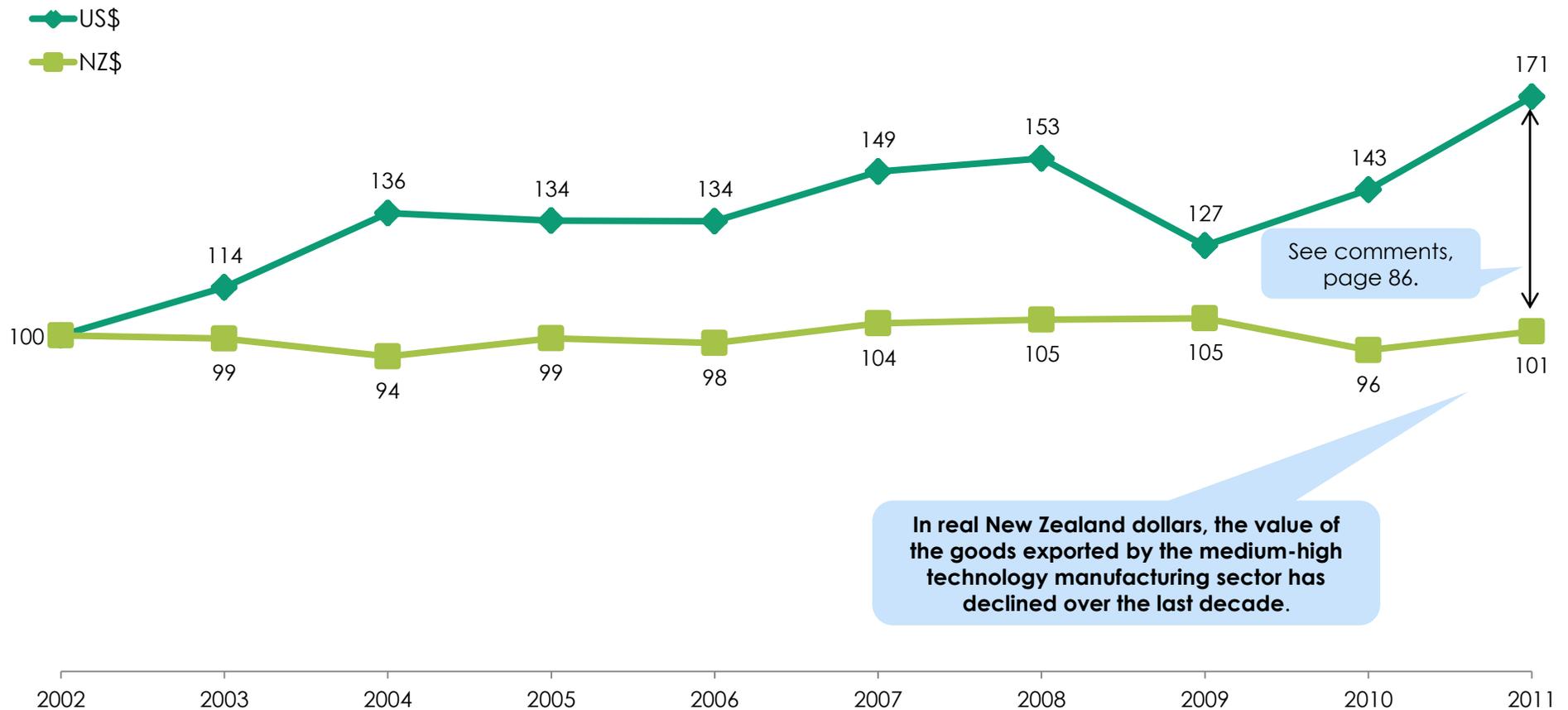
*NB: In theory, each index measures exactly the same parcel of goods. In practice, they measure slightly different parcels of goods, as a result of the respective sources allocating HS codes to ISIC or ANZSIC slightly differently. In addition, the 12 month period being measured differs for each source.

Medium-high technology manufacturing: effect of the exchange rate on export values

The nominal value of medium-high technology exports in US dollars has grown by 70% since 2002, whereas the nominal value of the same* goods in NZ dollars has been flat

Index of export value: NZ\$ vs US\$

2002=100; nominal; total value of the goods exported by the medium-high technology manufacturing sector



Source: US\$ values: OECD STAN Bilateral Trade Database; NZ\$ values: Statistics NZ, Merchandise Exports (MBIE concordance HS to ANZSIC)

*NB: In theory, each index measures exactly the same parcel of goods. In practice, they measure slightly different parcels of goods, as a result of the respective sources allocating HS codes to ISIC or ANZSIC slightly differently. In addition, the 12 month period being measured differs for each source.

Exchange rate: industry comment

Industry leaders commented that the high exchange rate has had a significant impact on the sector in recent years

- *Quite a bit of the flattening out of export growth in the last four years or so might not be because of underlying volume growth flattening out. The rising New Zealand dollar ...means that if you are selling 10% more every year you may have seen no growth in New Zealand dollar revenue terms.*
 - CEO, large high technology firm
- *Most people pick a number. ...[T]hey pick a number that says: this is our long-term viable position. And people were reasonably conservative about that number [a decade ago]. The numbers that I would hear would be in the realm of 70c against the US dollar. When it really started pushing beyond that, you really broke through the threshold of where they could remain profitable.*
 - Venture capitalist
- *We now get \$125 for **exactly** the same product that we used to get \$250 for [in] New Zealand dollars. So we've had to climb a very big hill in terms of exchange rate over the decade. The reason that we're actually more profitable now than we were a decade ago is because the underlying business has grown almost five-fold. ...so volume and sales value in foreign currencies have grown five-fold. You know, it's not very exciting to have earned only slightly more profit when your business is five times as big.*
 - CEO, large high technology firm
- *At these exchange rates – 20% above [the 10 year average] – it's pretty hard. Our staff start to look quite expensive. ...When you look at the true low cost countries, of China and Mexico and the like, you're down to about a fifth or sixth of the hourly rate of New Zealand, particularly at these exchange rates. And if your particular product has any measurable labour content in it, and I'd say anything more than about 10% or 15% of its total cost being labour, you're going to be thinking pretty seriously about manufacturing it somewhere else.*
 - CEO, large high technology firm
- *Assuming the New Zealand dollar stays roughly where it is, you might see a fairly rapid resurgence in growth, because that translation headwind would stop if the dollar just stayed flat at around its current levels.*
 - CEO large high technology firm

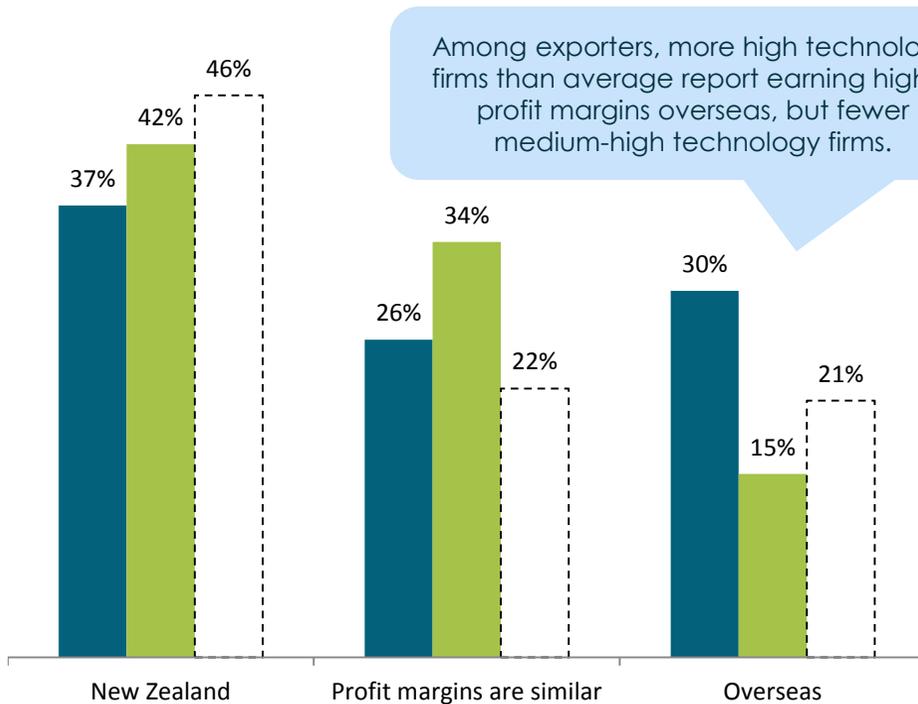
Location of higher profit margins: high technology vs medium-high technology

A minority of New Zealand exporters, including in the high & medium-high technology manufacturing sectors, report earning higher profit margins overseas

Location of higher profit margins

% of exporting firms reporting each source; 2011

- High technology manufacturing
- Medium-high technology manufacturing
- ⌋ NZ average

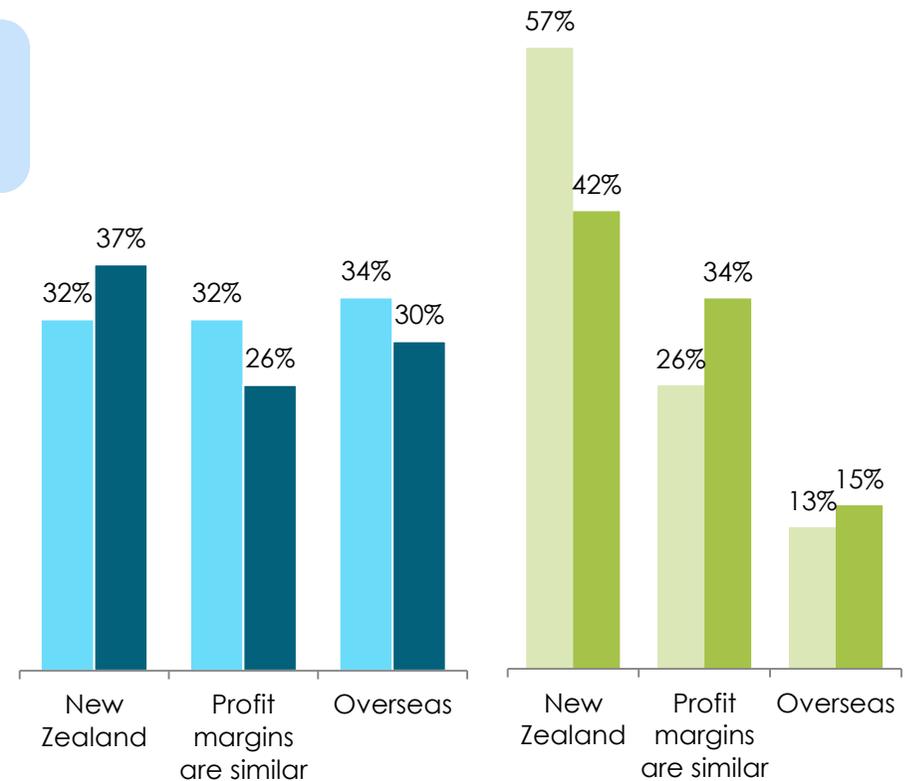


Among exporters, more high technology firms than average report earning higher profit margins overseas, but fewer medium-high technology firms.

Comparison with 2007

% of exporters; 2007 & 2011

- High technology
- Medium-high technology
- 2007 ■ 2011



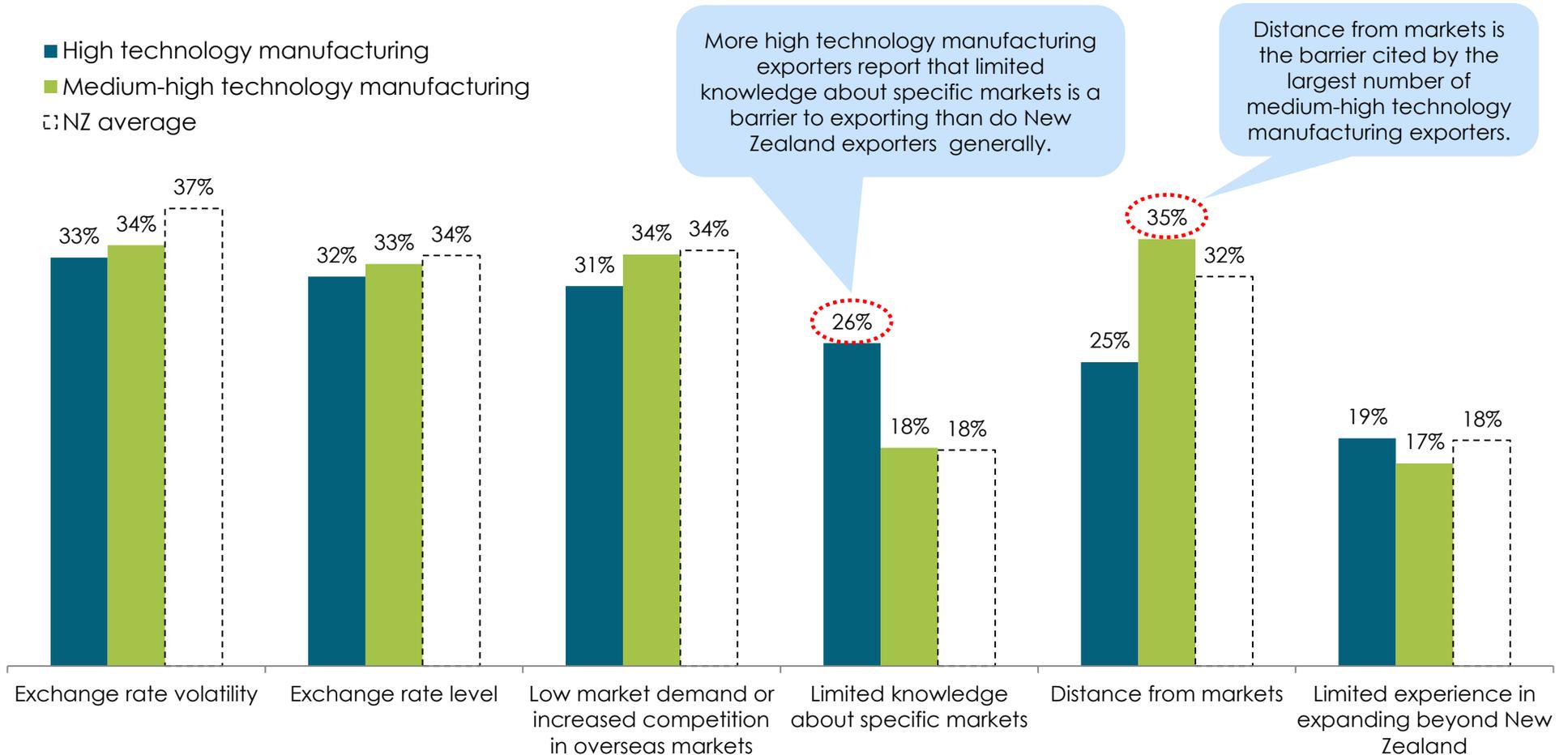
Leading barriers for existing exporters: high technology vs medium-high technology

Around one-third of high and medium-high technology manufacturing exporters highlight the exchange rate as a barrier to exporting, about the same as the NZ average

Number of exporting firms reporting the following factors as barriers to exporting

% of firms; 2011

- High technology manufacturing
- Medium-high technology manufacturing
- NZ average

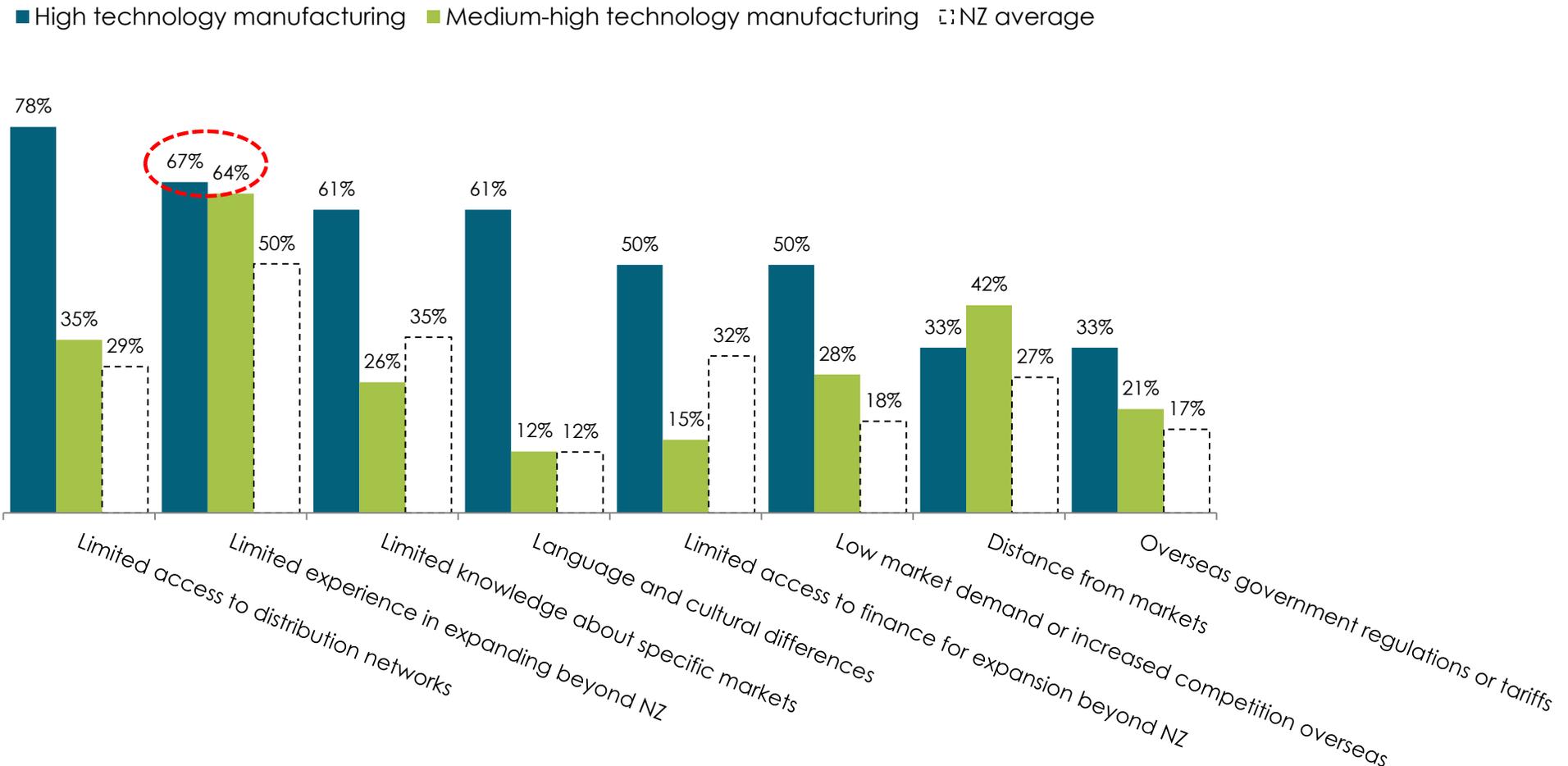


Leading barriers for potential exporters: high technology vs medium-high technology

Limited experience in expanding beyond New Zealand is the common barrier cited by potential exporters in both high and medium-high technology manufacturing

Number of potential exporters reporting the following factors as barriers to exporting

% of firms; 2011





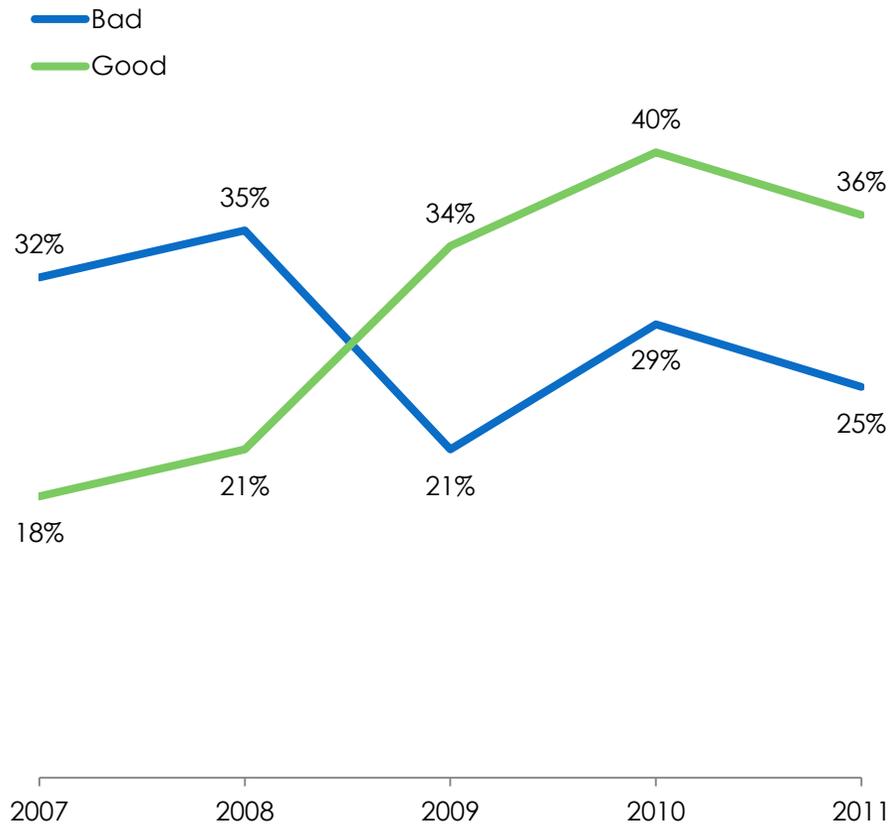
SKILLS

Workers' qualifications & quality: high technology vs medium-high technology

The perception of the quality of available labour has generally been improving, although it declined slightly in 2011

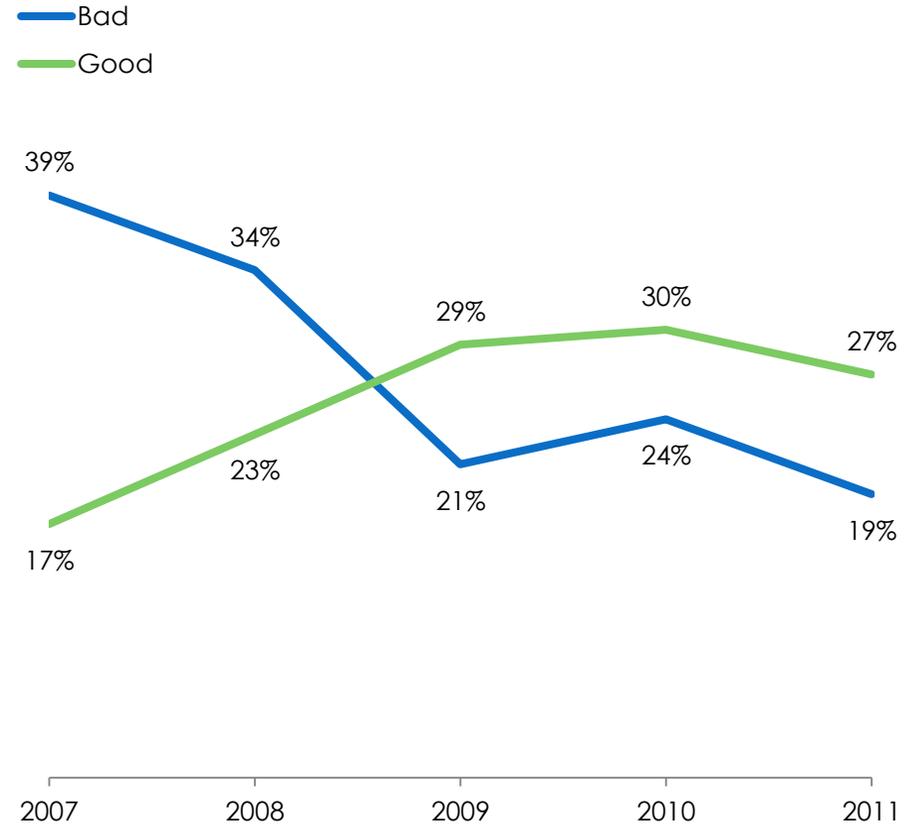
Perception of skilled labour in high technology firms

% of firms reporting each perception; 2007–2011



Perception of skilled labour in medium-high technology firms

% of firms reporting each perception; 2007–2011

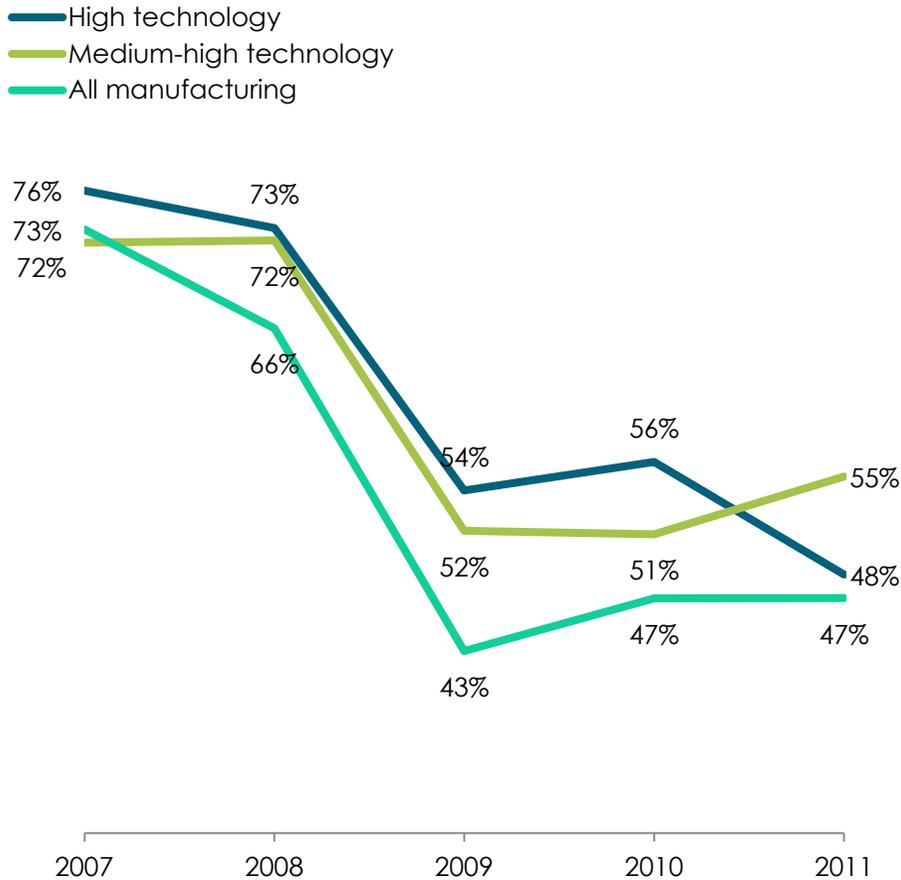


Recruitment: high technology vs medium-high technology

High technology firms report difficulty finding sufficient managers, professionals, and technicians; but recruitment is easier since the GFC

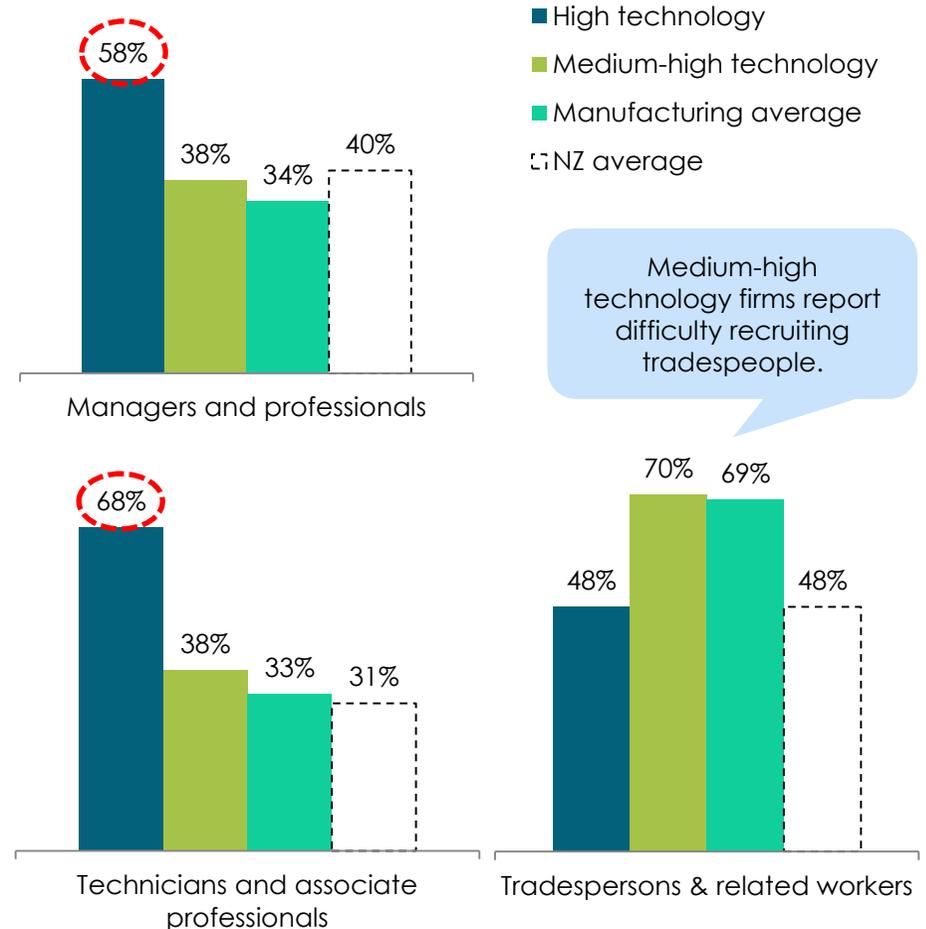
Firms reporting that it was hard to fill vacancies for at least one occupation group

% of firms; 2007–2011



Firms reporting difficulty recruiting particular occupational groups

% of firms; 2011



Skills: industry comment

There were a range of views on access to skills and talent, with the large high technology firms seen as important sources of experience

- *There's this emergent theory that we just suffer from a lack of management talent. But, really, in my experience, it isn't that. ...Can you get talent? Yeah, talent's there. It's absolutely there. You've just got to have an attitude to go and get them and pay for them. And you've got to have the money to pay for them.*
 - CEO, med-high technology firm
- *Most of the product design – and I've been involved with probably 15 businesses – most of the product design, generally the guy will have on his CV that he worked for F&P Healthcare. There's just so much expertise that comes from those sorts of companies. Most of our electronics capabilities will have come from somebody that has spun out of Tait at some point in their life. They really do make a difference. We're implementing some of our more sophisticated management stuff and we're pulling that out of Gallaghers. They're really top notch in some aspects. Once you've got those skills and that expertise, it really makes a difference to the economy.*
 - Venture capitalist
- *The reality is that one of our competitive advantages is that we are a lower cost highly educated country.*
 - CEO, large high technology firm
- *At a graduate level, there are some smart people. I think there is a lot that can be done for tailoring courses towards more vocationally relevant engineers. I think that can be looked at on a skill basis. But, actually, in just saying that, I think we're probably pretty good. If you compared us against many economies, I think our engineers are actually pretty darn good.*
 - CEO, high technology firm
- *[Despite cost advantages, New Zealand] is a pretty bad location when you're actually trying to find anyone with any experience. ...It's a pretty small pool to dip into.*
 - CEO, large high technology firm



INNOVATION

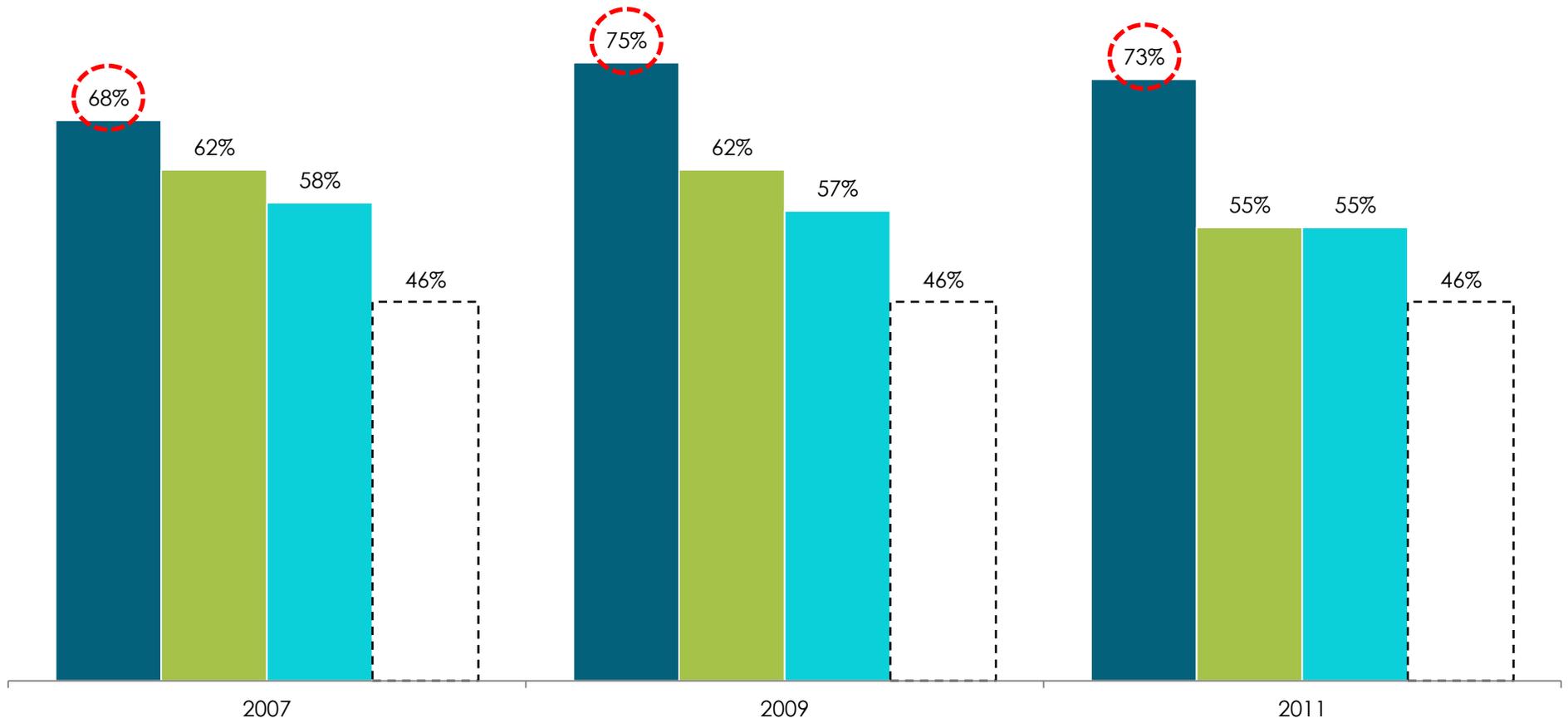
Innovation rate: high technology vs medium-high technology

More high technology manufacturing firms engage in innovation activities than other manufacturers

Firms reporting innovation

% of firms; 2007, 2009 & 2011

■ High technology manufacturers ■ Medium-high technology manufacturers ■ Manufacturing average □ NZ average



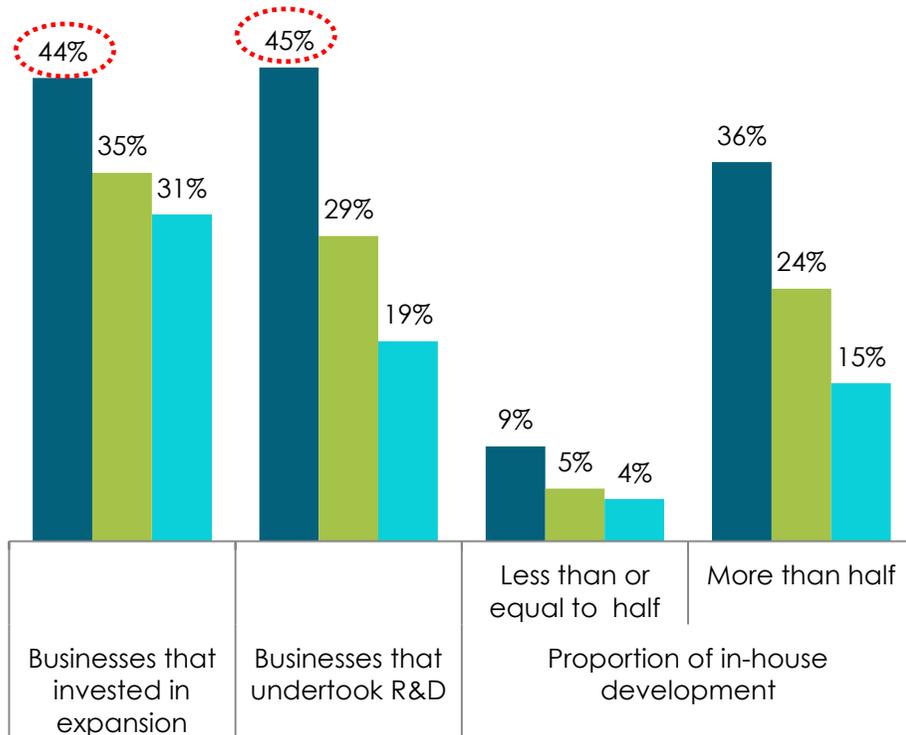
Investment in expansion and R&D: high technology vs medium-high technology

A third of high technology manufacturing firms perform over half of their R&D in-house, spending an average of \$1.3m per year, almost four times more than the NZ average

Investment in expansion and R&D

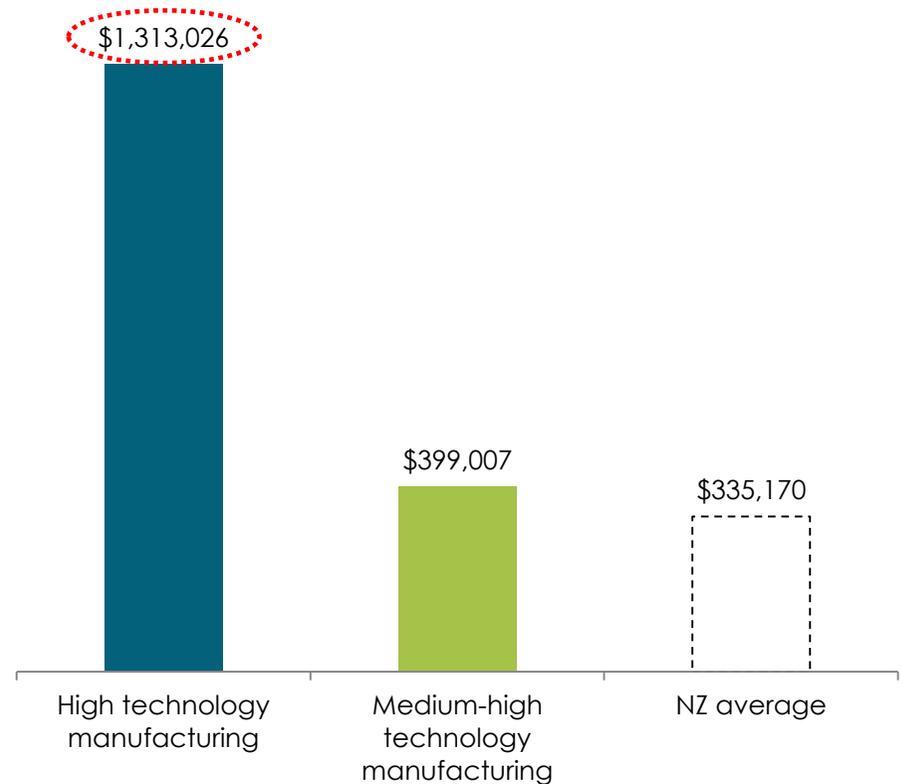
% of firms; 2012

- High technology manufacturing
- Medium-high technology manufacturing
- All manufacturing



R&D expenditure per firm

NZ\$; 2012



New-to-market product innovations: high technology vs medium-high technology

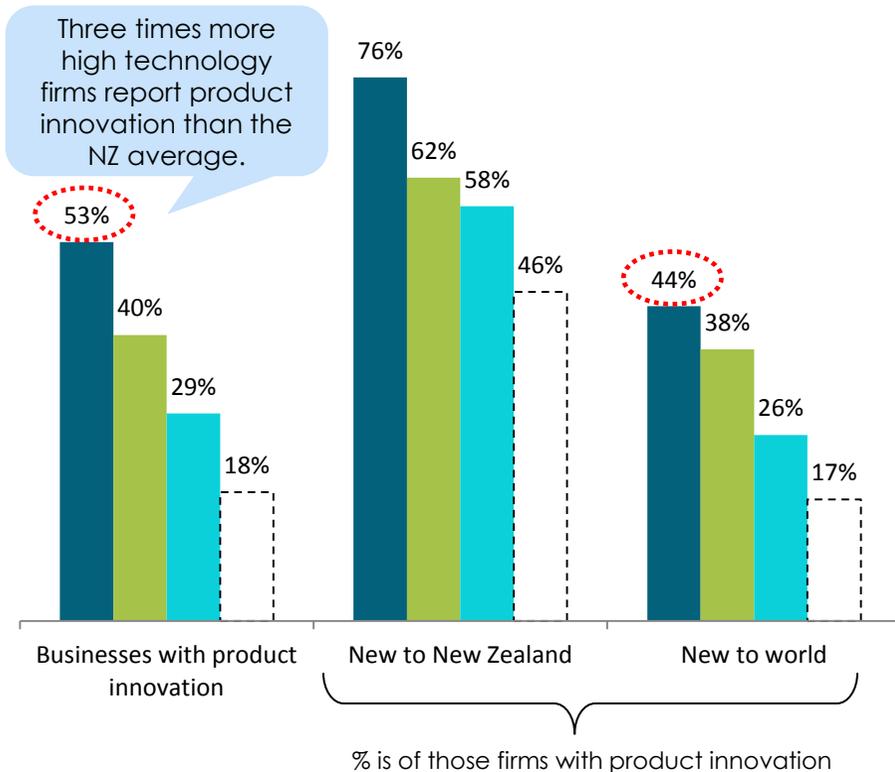
Over half of high technology firms reported new-to-market product innovations; 44% of those with product innovations reported that those innovations were new to the world

Firms reporting new-to-market product innovations

% of firms; 2011

- High technology manufacturing
- Medium-high technology manufacturing
- Manufacturing average

⌄ NZ average

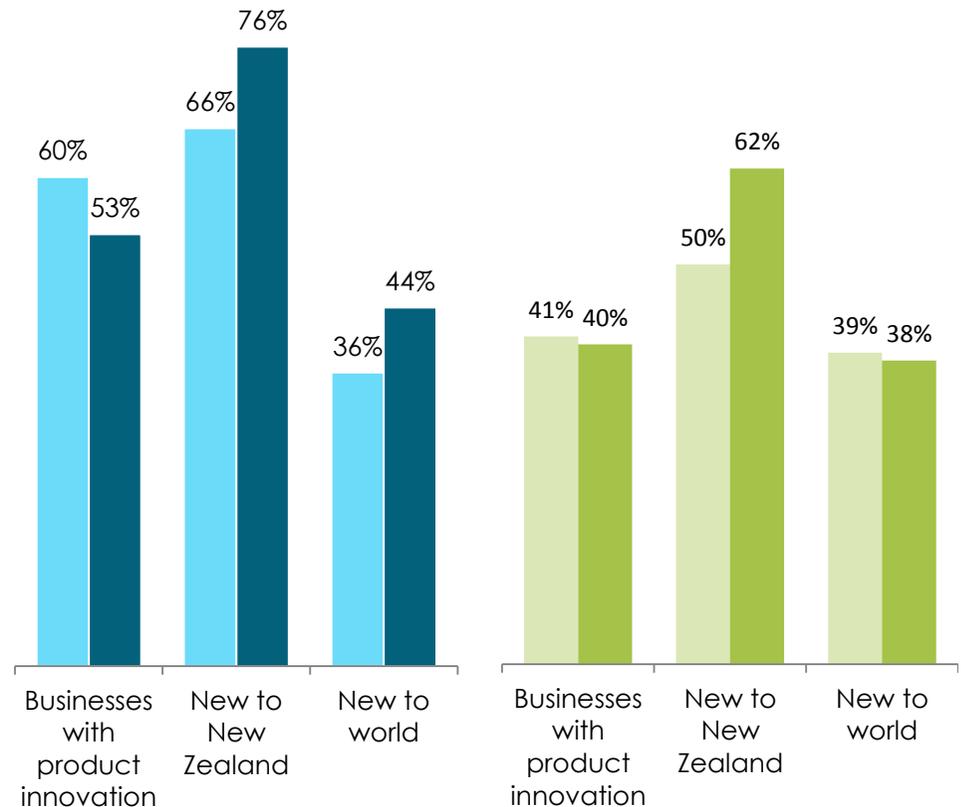


Comparison with 2009

% of firms; 2011

- High technology
- 2009
- 2011

- Medium-high technology
- 2009
- 2011



Innovation: industry comment

Comments point to New Zealand having cost and culture advantages in research and development and innovation generally

- *The high quality IP, as I've found over the last ten years, comes from these weird places that you'd have no reason for why that would take place in New Zealand.*
 - Venture capitalist
- *Having worked and lived in international markets, I think New Zealanders are quite unique in that we wear multiple hats, and we tend to have a broader view of a business and its operations. So we bring a broader perspective to problems we might be wanting to solve, or something we might be trying to innovate on. Also, the small scale means that sometimes we are literally in each others pockets, sitting next to each other cross-functionally. And that breeds a healthier environment in terms of cross-function communication. So we can solve problems from a number of perspectives. In my experience, this is not true of businesses in other parts of the world, even in Australia.*
 - CEO, large high technology firm
- *It can be the funniest things, and unrelated things, that you've got companies in NZ that do okay in. And one of the benefits of relatively large niches by our measure, but small by global measures, means that your giant companies probably haven't got around to them yet, so it means you can do pretty well in them.*
 - CEO, large high technology firm
- *Our ability to be innovative is talked about a lot, but it's absolutely right. We are fantastic at the innovation piece, and we're fantastic at doing low cost innovation, given our general lack of capital.*
 - CEO, high technology firm

Innovation: industry comment

- *We asked a [venture capital] guy from the US down ...and [he] visited a bunch of high tech businesses in New Zealand. At the end of the tour he was absolutely shocked at how much we were doing, with how little we had, to the extent that he was going to bring his portfolio of CEOs to New Zealand to show them how to do the innovation game. But in the same breath he said: 'you've got no idea how to take this to market'.*
 - Venture capitalist
- *If you look at remuneration in New Zealand for a research and development engineer, and compare that with Australia, ...when you look at the exchange rate and when you look at remuneration, you probably need to add nearly 50% onto the cost. If you go to the US, you better double it or more. If you go to Europe, you better double it or more. So when you compare us with other developed countries, New Zealand is probably close to half the cost. And we can see that. ...[W]e are about half. That's mainly remuneration, is the reason why New Zealand is quite a good location [for doing research and development].*
 - CEO, large high technology firm
- *Where we've got a huge, huge advantage over the rest of the world is that our people will often span silos. In the rest of the world you get real silo expertise. We span silos. Often times the really good innovations come from spanning silos and applying something that's done in one silo to another area.*
 - Venture capitalist
- *[The R&D team] punch considerably above their weight when you compare them to other companies, and the culture in New Zealand is very unique.*
 - CEO, Fisher & Paykel Appliances, nzherald.co.nz, April 8, 2013

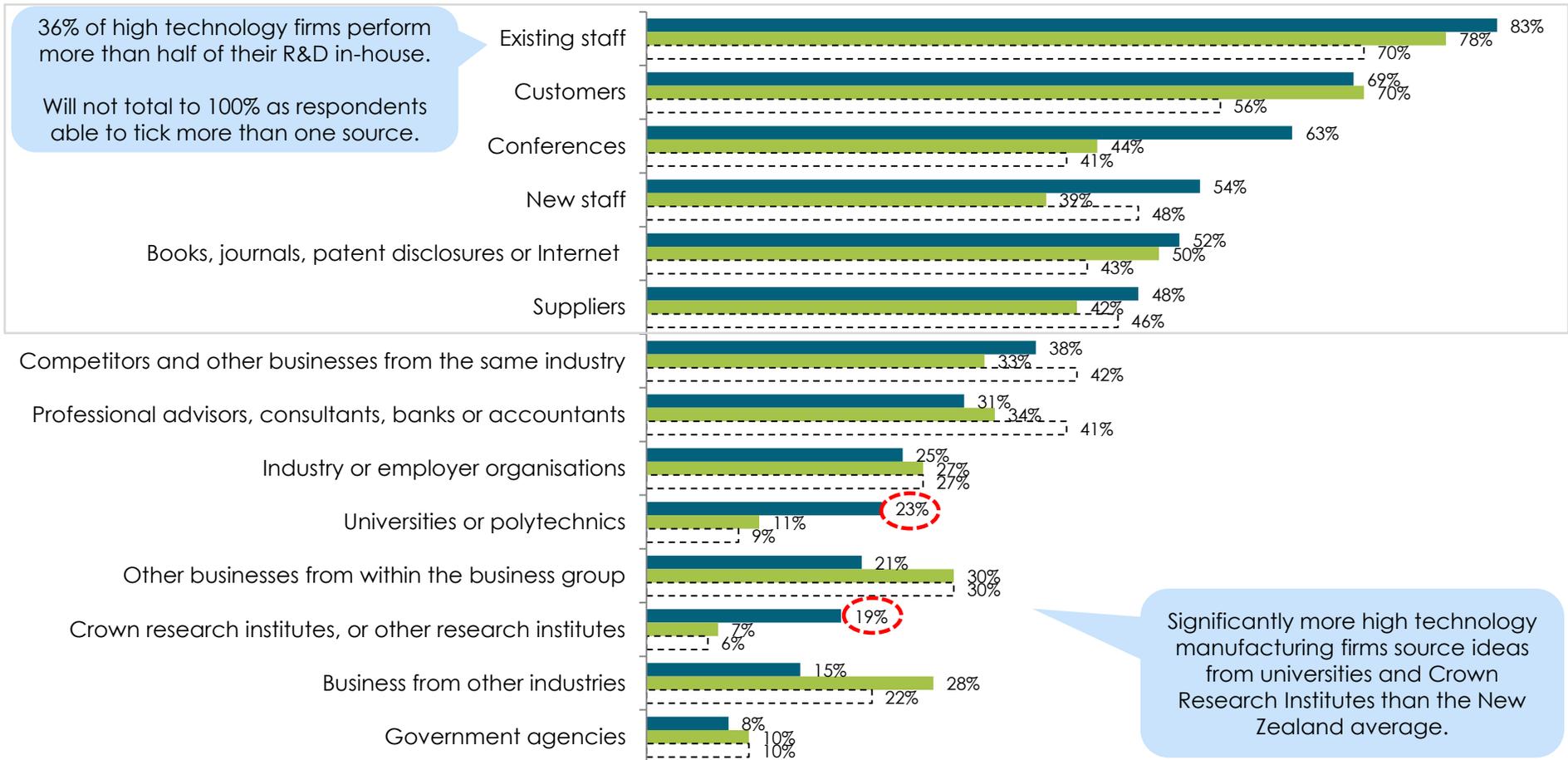
Source of ideas for innovation: high technology vs medium-high technology

Staff, customers, suppliers, and formal and informal business networks are the key sources of ideas for innovation in the high and medium-high technology sectors

Sources of ideas or information for innovation

% of firms reporting each source; 2011

■ High technology manufacturing
 ■ Medium-high technology manufacturing
 - - - NZ average



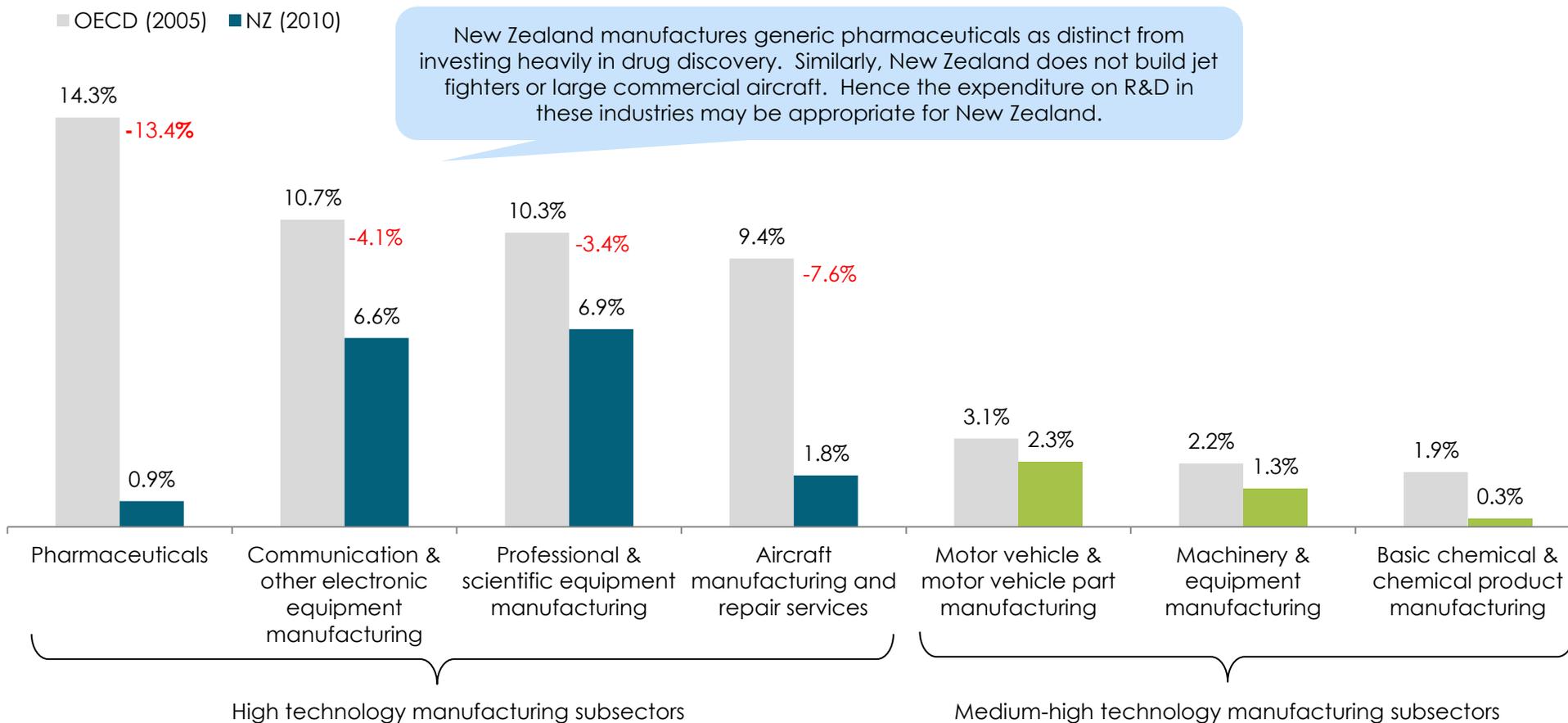
Source: Statistics New Zealand, Business Operations Survey (2011).

Research & development: high technology vs medium-high technology

Investment in R&D is below that of OECD peers, particularly in pharmaceuticals, aircraft manufacturing, and chemical product manufacturing

Expenditure on R&D as a percentage of sales

% of sales (net of the change in stocks); 2010, 2005



Note: As these are industry averages, individual firms differ; for example, Tait Communications reports that it invests 15% of its revenues in R&D, and F&P Healthcare invests 8%.

Source: Statistics New Zealand (NZ data); European Commission – Joint Research Centre (OECD data)

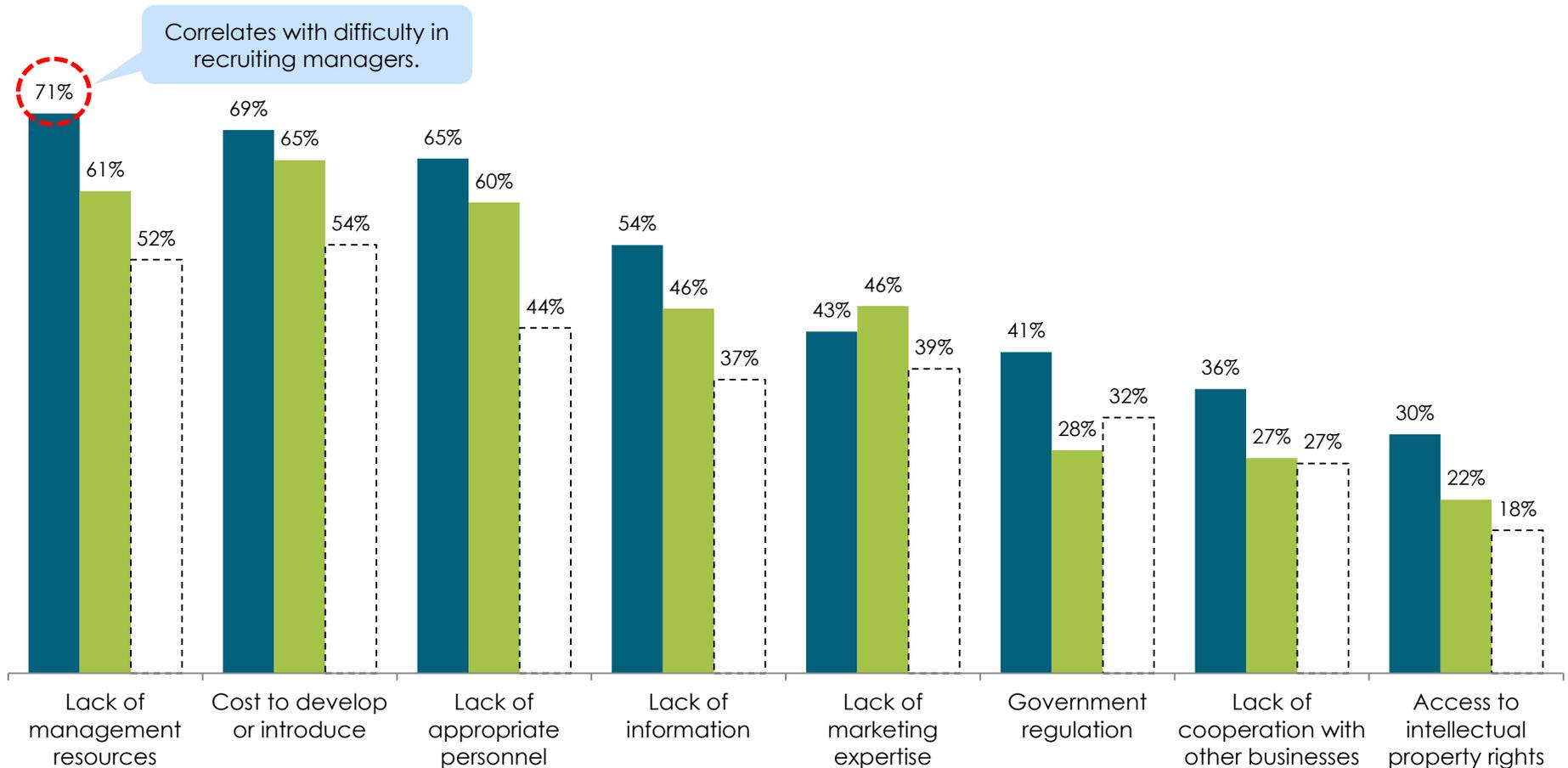
Barriers to innovation: high technology vs medium-high technology

While more high technology manufacturing firms innovate than average, more report facing barriers to undertaking that innovation

Firms reporting barriers to innovation

% of firms; 2011

■ High technology manufacturing ■ Medium-high technology manufacturing ▭ NZ average



Financing innovation: industry comment

Comments suggested that marketing new innovations is the more expensive part of the commercialisation process

- *You know, when you get into this stuff... you go and do R&D at the lab bench, and you think that largely solves the problem. But, in reality, once you've cracked it at an R&D level, you're probably 10% or 20% of the way into your journey. So people can get a little disenchanted or disheartened as they go through the process.*
 - Venture capitalist
- *I would say that virtually anyone in the capital markets who's been there for any length of time will have put money into a really exciting growth story and watched it all disappear at some point in their career. There is just a huge amount of scepticism. When people come forward with opportunities, they just think, no no, it's going to blow up.*
 - CEO, med-high technology firm
- *The stuff that comes out [of the innovation system, i.e. ideas for new businesses], it needs a good couple of million dollars to really prove out its IP position and even work out that it's got some kind of opportunity. Once you've got to that, then you need more and more capital to start getting your initial prototypes done, your scale manufacturing prototypes established; just so much capital required. This is your \$10, \$20 million type lumps.*
 - Venture capitalist
- *When you look at the innovation game, ...there are certain objective standards your product has to get to. If you don't get your product to that level, you just don't get to play the game. What's ended up happening in New Zealand, because we don't have access to \$20 million – we might have access to \$5 million – the first \$5 million goes in to developing a good product that meets the standards. We don't see the \$15 million it takes to get you into the market.*
 - CEO, med-high technology firm
- *Any new venture has a fairly lengthy period of consuming cash and not earning it. And, in [our industry], I would argue that that is at least 10 years, because you've got long development cycles, long validation cycles... And if what you're doing is not a "me too", you're probably changing [consumer] practice in some way – for a better result, but that has a conceptual sell associated with it. That's certainly our history. Everything that we've ever done has in some way changed [consumer] practice for the better, ...but that takes time.*
 - CEO, large high technology firm



FINANCIAL PERFORMANCE

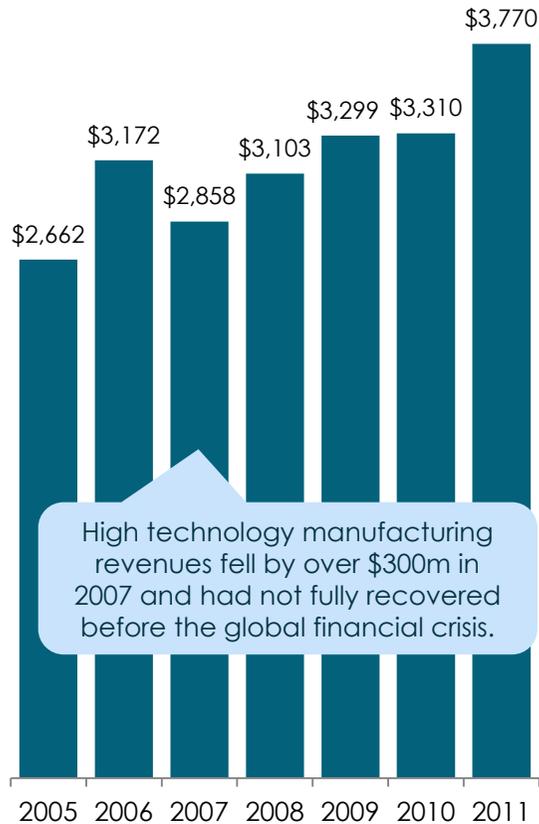
Revenue

The combined revenue of medium-high technology manufacturers fell during the GFC and is yet to do better, while high technology manufacturing revenue grew throughout

Total revenues

NZ\$m; nominal; 2005–2011

High technology



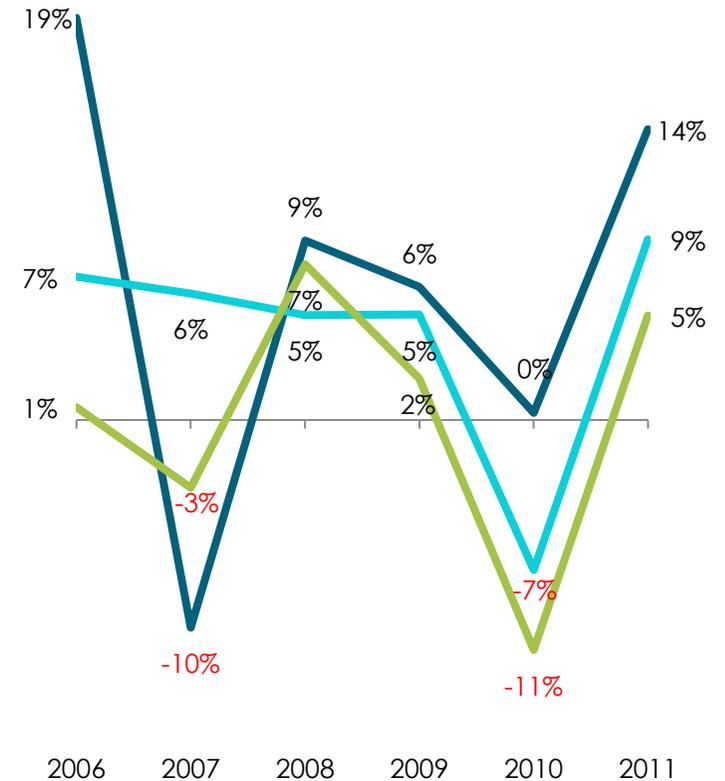
Medium-high technology



Annual growth in sector revenues

%; nominal; 2006–2011

- High technology manufacturing
- Manufacturing average
- Medium-high technology

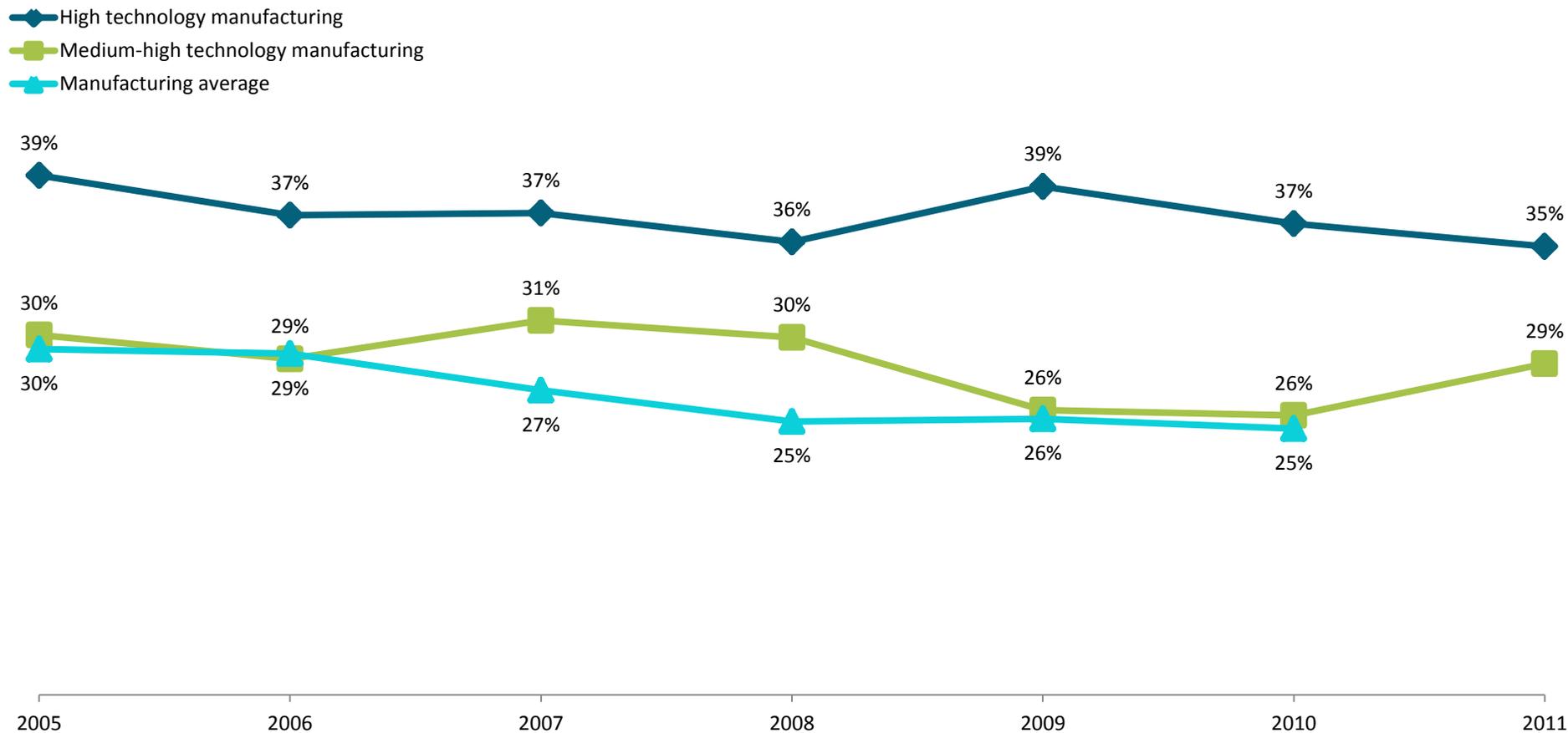


Value added

High technology manufacturing firms add greater value than other manufacturing firms

Value added as a share of sales revenue

% of total sales income; 2005–2011



Source: Statistics New Zealand, Annual Enterprise Survey

Note: the manufacturing average uses the official GDP figures, which were only available to 2010. The two cross-cutting sectors use an unofficial estimate of value added, calculated by Statistics New Zealand for the purposes of this report.

Productivity

Firms in high and medium-high technology manufacturing are generally more productive than the average firm in New Zealand

Surplus before income tax, plus salaries and wages paid, per employee

NZ\$000; nominal; 2005–2011

- High technology manufacturing
- Medium-high technology manufacturing
- Manufacturing average
- NZ average

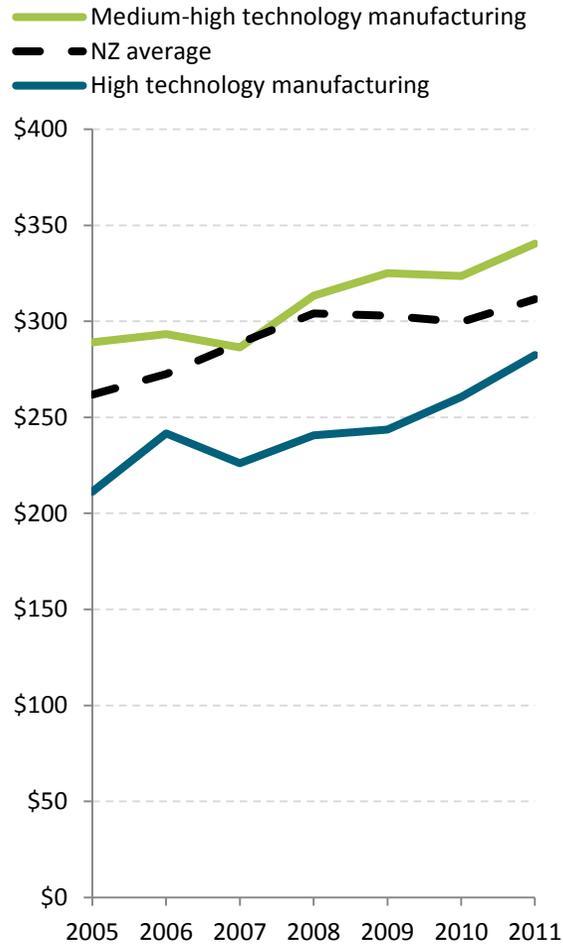


Financial performance

High technology manufacturing firms generate less revenue and lower profits per worker than average, but a higher return on equity

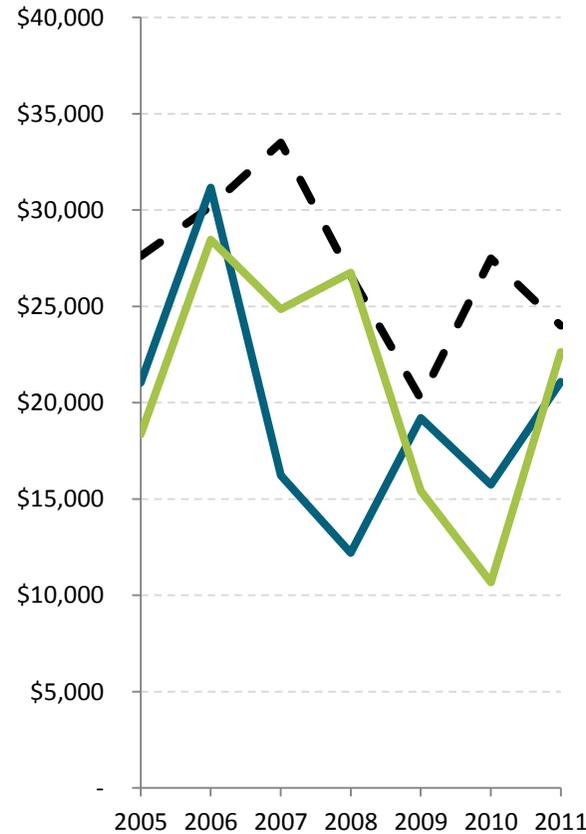
Total income per employee

NZ\$000; nominal; 2005–2011



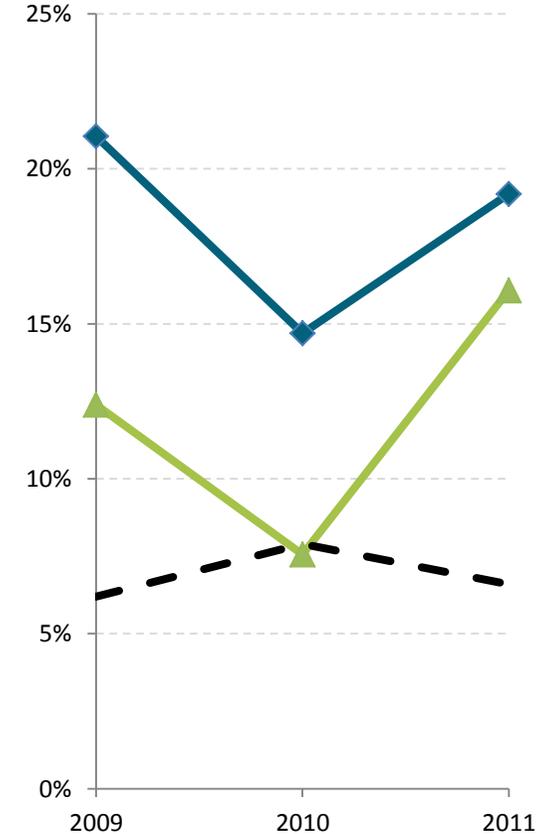
Surplus per employee

NZ\$000; nominal; 2005–2011



Return on equity

%; 2009–2011

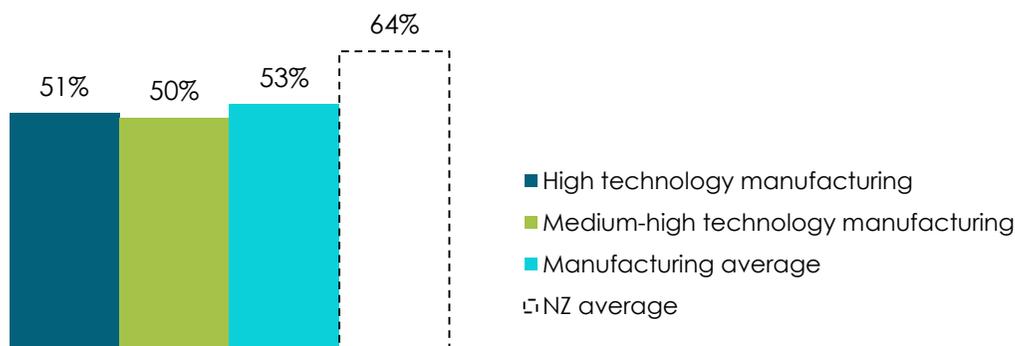


Balance sheet

High and medium-high technology manufacturing firms have slightly lower levels of debt and lower tangible assets than the average firm

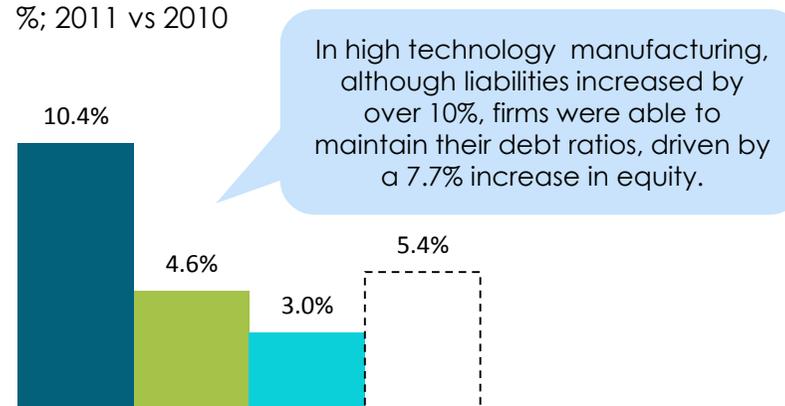
Debt ratio

% of total assets; 2011



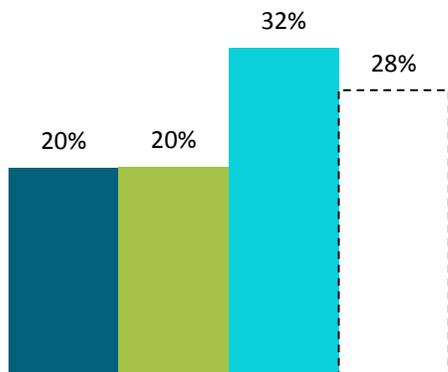
Change in total liabilities

%; 2011 vs 2010



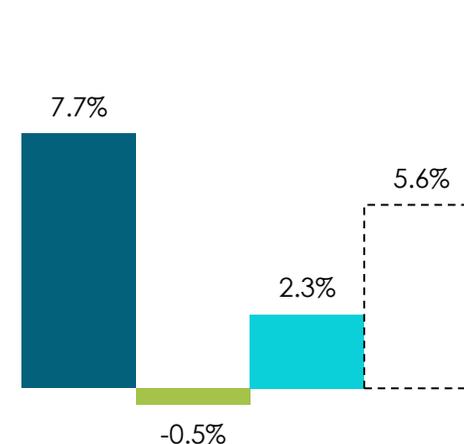
Tangible assets as a % of total assets

% of total assets; 2011



Change in equity

%; 2011 vs 2010





LOOKING AHEAD

Start-ups and next tier

There are a large number of smaller firms and innovative start-ups poised for growth, as these examples show

Brief profile of selected start-up / next tier high and medium-high technology firms; 2012, or as available

Firm	Revenue	Employees	Ownership	Description / products
Arc Active (med-high tech)	Pre-revenue	12	Private / venture	Negative electrode battery technology to significantly increase fuel efficiency of start/stop and hybrid vehicles.
Mesynthes (high tech)	n/a	n/a	Private / venture	Medical devices specialising in wound care.
Mimomax Wireless (high tech)	\$2m (est)	19	Tait Foundation	Ultra-high spectral efficiency and very low latency, long range wireless solutions for mission-critical applications including SCADA, power line protection, PMR linking and/or IP backhaul linking.
PowerbyProxi (high tech)	n/a	n/a	Private / venture / University of Auckland	PowerbyProxi develops high-efficiency industrial wireless power solutions that eliminates the need for physical power connections in environments which are hostile to cables.
Canterbury Scientific (high tech)	\$5m (est)		Private / venture	Freeze-dried and ready-to-use liquid haemoglobin control products.
Invert Robotics (high tech)	n/a	n/a	Private / venture	Builds and operates wirelessly controlled wall-climbing robots that perform high-precision tasks in high-risk environments.
Kahne Animal Health (high-tech)	n/a	11 (est)	Private / venture	Sensor-based wireless monitoring systems used to track health and fertility in cows.
Technopak (med-high tech)	\$9m (est)	23	Private	Technopak designs, manufactures and installs hygienic 25kg bag filling and packing lines, bulk bag filling equipment and complete powder handling and conveying systems for the dairy, infant formula, nutrition and pharmaceutical industries.
EnaSolar	n/a	30 (est)	Private, wholly owned subsidiary of Enatel.	Solar inverters to convert the energy collected by solar panels from direct current into alternating current to run appliances in homes.

Manufacturers becoming software developers and service providers

High and medium-high technology manufacturing firms are increasingly integrating software and service components into their products, as these examples show

Firm	Product	Software	Service
FrameCad (medium-high)	Roll formers: innovative manufacturing equipment for consistent, quality steel frames and trusses. Building products.	<i>FRAMECAD Integration Software Solution – Accurate Architectural Design Software Building design, engineering, detailing, quoting, production planning, factory management, machine control and materials management can all be easily and intuitively handled using FRAMECAD's comprehensive, integrated software suite.</i> – FrameCad website	Design services. Consulting and training services.
BCS Group (medium-high)	A wide range of hardware for airport baggage handling systems, logistics and selected manufacturing industries.	Range of software solutions.	Design, operation and maintenance services.
Scott Technology (medium-high)	Appliance manufacturing systems, meat processing automation, sample preparation equipment for the mining and minerals sector, and high temperature superconductors.	Automated systems and robotics need software to run them.	<i>Scott Service is a globally mobile, dynamic team which services equipment manufactured by Scott's Appliance Systems and Meat Processing divisions.</i> –Scott Technology website
Tait Electronics (high)	A range of wireless and portable radios.	A range of software packages and embedded software in products.	Design, deployment and support services.
Ike GPS (aka Surveylab) (high)	Hand-held devices that integrate hardware and software and enables anyone from a utility to a mining company to measure and model anything.	<i>Even two years ago we were all about the hardware," says [Chief Executive] Milnes. "Today, in terms of our engineering resources 70% of what we do is software driven." And though ikeGPS has patents and trade secrets around the hardware, its increased software focus is to "provide an end-to-end industry solution," he says.</i> – sciblogs.co.nz, November 2012	

Manufacturing going digital

3D printing and the related suite of capabilities has the potential to change the face of manufacturing

- *3D printing is fantastic for prototyping, and may have broader applications in the longer term. We have three or four 3D printing machines running 24/7. We've been buying a new one every six months or so. The cost has gone down... and its just astonishing what they can do for you. ...[for prototyping] you're going from months, to days to hours.*
 - CEO, large technology company
- *3D printing is a strange meme that is being misrepresented in the press by people who don't actually use them... If you had to pry machines out of my hands, in order you'd first have to fight over the laser cutter, then you'd have to fight over the precision mill, then you'd have to fight over the large format mill, then we'd get up to the 3D printer... just this obsession with 3D printing - that alone is not going to up-end industry. But if you enlarged the slightly misinformed belabouring of 3D printing and instead talk about the suite of capabilities, meaning the suite of these capabilities that let you do additive, subtractive, 2D, 3D, form, function, electronics, actuated sensors, all of that - then, that blows up industry. And in fact it blows up industry in a way we can predict with great historical accuracy... just mentally replay the script of music and software and computers and that's what's happening today [with manufacturing]. [Where] the research is heading is the idea of digital information actually in the materials themselves. It may sound semantic, but the difference between an analogue telephone and the Internet isn't semantic, its fundamental. And this is fundamental in that sense. In the long term that's why a lot of the coverage today of 3D printing is misguided, because it's missing the deeper research story, which is digitising not the design, but the materials.*
 - Neil Gershenfeld, professor at MIT and the head of MIT's Centre for Bits and Atoms, interview on Peter Day's World of Business, BBC podcast, 1 June 2013
- *[Wellington based company] Ponoko builds on the success of the information age, and applies it to digital fabrication. Customers who have digital designs can contract with Ponoko, and sell their objects either via the Ponoko site, or their own retail outlets. Ponoko takes orders, and has it printed in 3D or cut at the time of purchase by laser cutters or CNC milling machines or 3D printers. The manufacturers exist in a distributed network that is growing around the world, and often the manufacturer closest to the customer is sourced.*
 - Wikipedia
 - See also www.ponoko.com

Food and beverage manufacturing and high technology manufacturing

Technology in food and beverage is largely embodied in the machines, processes and materials used in the manufacturing of food products

- Globally, the level of R&D undertaken by Food and Beverage (F&B) firms is low compared with other sectors. As such, the F&B industry is often classed as “low-tech” and “mature”.
- Globally and locally, the F&B sector is a heavy user of technology and knowledge developed by a range of high and medium-technology sectors e.g. chemicals, pharmaceuticals, biotechnology, new materials, electronics, communications, process engineering and services.
- In New Zealand, many small and medium sized F&B firms (some with a turnover as large as \$200m p.a.) do little R&D but make extensive use of technologies from other sectors. These include:
 - food ingredients, flavours, fragrances, preservatives and other additives, logistics and supply chain management, material handling, leak detection, storage, process engineering, quality and safety testing, extended shelf-life processing and packaging, ultra-filtration, cooling and refrigeration, transport, fermentation, molecular genetics and applied enzymology, pilot plant facilities, robotics and automation such as fruit picking machines, automated carcass cleaning and boning facilities.
- Equipment suppliers have an important role in providing new knowledge and product and service innovations to F&B firms. For example, Scott Technology invests in R&D to develop automation for the meat industry. A meat processing company benefits from this R&D but does not record R&D expenditure itself. It's investment in innovation is in the purchase of the knowledge embedded in the technology of the machine.
- The Food Innovation Network New Zealand has been established with one of its functions being to facilitate the use of the latest technologies by the New Zealand food and beverage industry. The New Zealand Food Innovation Network (NZFIN) is an accessible, national network of science and technology resources created to support the growth and development of New Zealand food & beverage businesses of all sizes by providing facilities and the expertise needed to develop new products and process from idea to commercial success.
 - www.foodinnovationnetwork.co.nz

Developing ecosystem

In the last decade the ecosystem needed to support the growth of technology firms (broadly defined) has developed in breadth and depth, as these examples show

Selected examples of components of New Zealand technology innovation system

Firm	Description / products	Date est.	Website
Capital	New Zealand Venture Investment Fund	2002	www.nzvif.co.nz
	Seed Co-Investment fund	2005	www.nzvif.co.nz
	New Zealand Venture Capital Association	2001	www.nzvca.co.nz
	Angel Association of New Zealand	2007	www.angelassociation.co.nz
Incubators / innovation parks / business support / economic development	AUT Business Innovation Centre, Auckland	2001	www.enterprises.aut.ac.nz
	Ecentre, Auckland	2001	www.ecentre.org.nz
	The Icehouse, Auckland	2001	www.theicehouse.co.nz
	Powerhouse Ventures, Christchurch	2001	www.powerhouse-ventures.co.nz
	New Zealand Trade and Enterprise	2003	www.nzte.govt.nz
	Creative HQ, Wellington	2003	www.creativehq.co.nz
	Waikato Innovation Park	2004	www.innovationwaikato.co.nz
	Upstart, Dunedin	2004	www.upstart.org.nz
	BioCommerce Centre, Palmerston North	2004	www.thebcc.co.nz
	SODA Inc, Hamilton	2009	www.sodainc.com
Auckland Tourism Events and Economic Development (ATEED)	2010	www.businessaucklandnz.com	
Events and awards	Annual High Tech Awards	1996	www.hitech.org.nz
	Annual Morgo Conference	2010	www.morgo.co.nz
	ANZ Flying Start Business Plan Competition	2011	www.business.govt.nz/business-plan-competition
	New Zealand Innovators Awards	2011	www.innovators.org.nz
Publications /media	Unlimited magazine	1998	unlimitedmagazine.co.nz
	TIN 100 Report	2005	www.tinetwork.co.nz
	Ideolog magazine	2005	www.idealogue.co.nz
	Science Media Centre	2008	www.sciencemediacentre.co.nz
	Sciblogs	2008	sciblogs.co.nz
Recent initiatives	EPIC (Enterprise Precinct and Innovation Campus) (stage 1) (Christchurch Innovation Precinct)	2012	www.epicinnovation.co.nz
	New Zealand Health Innovation Hub	2013	innovation.health.nz
	Callaghan Innovation	2013	www.callaghaninnovation.govt.nz
	Business Growth Agenda – refer pp23 ff.	2012	www.mbie.govt.nz

Industry comment: developing ecosystem

- *We're learning. We're probably at high school at the moment, in terms of our evolution. We've come out of kindergarten, and we're getting better. There's still a lot of naivety. I still see a lot of businesses that have gone and got themselves one patent and they think they can take on the world. If they've actually got something that's commercially relevant, they're just sitters for a patent law suit to knock them over. There's a lot of naivety still in the system, but we've learnt a lot.*
 - Venture capitalist
- *In New Zealand, we got our investment scene a bit out of order. VC came into its own in the early 2000s while angel investment has only really started to make significant strides in the last three to five years when our Government intervened with its NZ Venture Investment Fund. There are now angel groups in most cities in NZ, and last year the number of investments made was up 25% while the level of dollars invested was double. There really seems to be some momentum across New Zealand with now a realistic avenue for our Kiwi entrepreneurs who want to build global businesses.*
 - Andy Hamilton, CEO IceHouse (business incubator)
- *Ten years ago almost every company was making the same top six mistakes. Today probably still 60% of them are, but its down from 100%. And some of their issues are becoming slightly more complex, whereas a few years ago their issues were the same standard mistakes. We are starting to see a lot more sharing of experience. It's culture, not entrepreneurs in isolation, or leaders in isolation or education in isolation. There's an entire ecosystem that really has to assist that job and to grow and mature at the same time. But I think there is an awful lot of good foundations that will produce some good growth in the next few years, I really do.*
 - CEO, technology company
- *I started doing my investing in 2001. The standard between 2001 and 2012 is huge, the difference in standards. We're so much more sophisticated now than we were at that time. That's because money started turning up and we started learning and getting some experience. People might look at the VIF [New Zealand Venture Investment Fund] as not a great success story. But the reality is there's a lot of lessons learned off the back of money going into ventures and people learning. Money solves so many problems.*
 - Venture capitalist



APPENDIX: METHODOLOGY, DATA SOURCES AND LIMITATIONS

Definition

This report uses the OECD definition for high technology manufacturing

High technology manufacturing: OECD definition

- The OECD defines high technology manufacturing as the sub-set of manufacturing industries in which expenditure on research and development is greater than 8% of revenues when measured across multiple developed countries combined.
- The assumption made is that there is a strong link between technology and innovation. Firms that spend more on R&D are the firms that innovate more, win new markets, are more productive and pay employees more.
- Applying the OECD's definition, this report classifies the following nine industries as high technology manufacturing. Note that how statisticians and the OECD classify an industry and how the industry sees itself may be very different.
- The technicalities of the definition are explained in *Reviewing the nomenclature for high-technology – the sectoral approach*, by Alexander Loschky, published by the European Commission.*

ANZSIC code	Description	New Zealand examples
C184	Pharmaceutical and medicinal product manufacturing	
	C1841 Human pharmaceutical and medicinal product manufacturing	PharmaZen
	C1842 Veterinary pharmaceutical and medicinal product manufacturing	Argenta
C2394	Aircraft manufacturing and repair services	
	C2394 Aircraft manufacturing and repair services	Pacific Aerospace
C241	Professional and scientific equipment manufacturing	
	C2411 Photographic, optical and ophthalmic equipment manufacturing	
	C2412 Medical and surgical equipment manufacturing	F&P Healthcare
	C2419 Other (e.g. global positioning systems, magnetic resonance imaging, and radar)	AuCom Electronics
C242	Computer and electronic equipment manufacturing	
	C2421 Computer and electronic office equipment manufacturing	Novel Ways
	C2422 Communication equipment manufacturing	Tait Communications
	C2429 Other (e.g. transistors, semi-conductors, and circuit componentry)	Rakon

Source: Australian and New Zealand Standard Industrial Classification 2006 ('ANZSIC')

*The definition is available from: <http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/13523/1/reviewing%20the%20nomenclature%20for%20high-technology%20-%202010%20edition.pdf>

Definition

This report uses the OECD definition for medium-high technology manufacturing

Medium-high technology manufacturing: OECD definition

- The OECD defines medium-high technology manufacturing as the sub-set of manufacturing industries in which expenditure on research and development is between 2% and 8% of revenues when measured across multiple developed countries combined.
- The assumption made is that there is a strong link between technology and innovation. Firms that spend more on R&D are the firms that innovate more, win new markets, are more productive and pay employees more.
- Applying the OECD's definition, this report classifies the following industries as medium- high technology manufacturing. Note that how statisticians and the OECD classify an industry and how the industry sees itself may be very different.
- The technicalities of the definition are explained in *Reviewing the nomenclature for high-technology – the sectoral approach*, by Alexander Loschky, published by the European Commission.*

ANZSIC code	Description	New Zealand examples
C18	Basic chemical and chemical product manufacturing	
	C181 Chemical manufacturing	NZ Pharmaceuticals
	C182 Basic polymer manufacturing	Nuplex
	C183 Fertiliser and pesticide manufacturing	Zelam
	C185 Cleaning compound and toiletry preparation manufacturing	Skinfood
	C189 Other basic chemical product manufacturing	Arotec Diagnostics
C23	Transport equipment manufacturing	
	C231 Motor vehicle and motor vehicle part manufacturing	Designline International
C24	Machinery and equipment manufacturing	
	C243 Electrical equipment manufacturing	Wellington Drive Technologies
	C244 Domestic appliance manufacturing	F&P Appliances
	C245 Pump, compressor, heating and ventilation equipment manufacturing	Skope Industries
	C246 Specialised machinery and equipment manufacturing	Compac Sorting Equipment, Scott Technology
	C249 Other machinery and equipment manufacturing	Moffat, Glidepath, Buckley Systems
Others	C1915, C1916, C2393, C2399	Pacific Hovercraft

Source: Australian and New Zealand Standard Industrial Classification 2006 ('ANZSIC')

* See the link on the previous page.

Economic terms and definitions

The report uses the following economic metrics

Term	Definition	Comment
Employment	The number of people who earned money from employment (wages and salary earners) and/or self-employment. For tourism it is full-time equivalent (FTE) employees producing goods and services sold directly to tourists.	Cross-cutting sectors (excluding tourism) Statistics NZ, Linked Employee Employer Data (LEED), custom job. Tourism Direct employment in tourism (FTEs) and employment (FTEs) in tourism as a % of total.
Goods exports	The value of goods of domestic origin (excluding re-exports) 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.	All sectors Merchandise (goods) exports have been obtained by matching commodities to the ANZSIC06 industry that characteristically produces them. (Statistics NZ, custom job)
Investment in fixed assets (gross fixed capital formation)	A measure of the outlays of producers on durable fixed assets (e.g. buildings, vehicles, plant and machinery, hydro-electric construction, roading and improvements to land). 'Gross' indicates that consumption of fixed capital is not deducted from the value of the outlays.	Cross-cutting sectors (excluding tourism) Uses additions less disposals of fixed assets (custom job). Note: this data has not been through the System of National Accounts, so is indicative only.
Nominal GDP (Gross domestic product)	The value of goods and services produced in New Zealand, after deducting the cost of goods and services used in the production process. 'Nominal' means not adjusted for inflation.	Cross-cutting sectors (excluding tourism) Value added has been used to provide indicative estimates. These have not been verified through the System of National Accounts.
Number of firms (number of enterprises)	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.	Cross-cutting sectors (excluding tourism) Uses customised Business Demography Statistics, number of enterprises.
Productivity	A measure of how efficiently inputs are used within the economy to produce outputs. Productivity is calculated by dividing the sector's real GDP by the number of hours paid. Real GDP per hour paid is used. For the cross-cutting sectors nominal GDP per employee is substituted.	Cross-cutting sectors (excluding tourism) For cross-cutting sectors real GDP is replaced by nominal GDP, and hours paid is replaced by number of employees; hence calculation is nominal GDP by number of employees.
Real GDP (Gross domestic product)	GDP adjusted to remove the effect of price changes/inflation to show the change in the volume of goods and services produced in New Zealand. In this report, it is expressed in constant 2010 prices.	Cross-cutting sectors (excluding tourism) Data not available.

Financial terms and definitions

The report uses the following financial metrics

Term	Definition	Comment
Capital stock per worker	Indicates capital intensity. The capital stock includes fixed assets such as buildings, roads and machinery, and intangible items such as software and exploration expenditure, less accumulated depreciation.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job. Tourism Capital stock, divided by employment.
Debt ratio	Debt ratio equals total liabilities of all firms in sector divided by total assets of all firms in sector.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job.
Return on equity	Surplus before income tax divided by shareholders' funds.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job.
Surplus per employee:	Surplus before income tax of all firms in sector divided by rolling mean employment.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job.
Total income per employee:	Total income of all firms in sector divided by rolling mean employment. Total income includes sales, interest, dividends, donations, government funding, grants and subsidies, and non-operating income.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job.
Total income per firm	Total income of all firms in sector divided by the number of firms in the sector. Income includes sales, interest, dividends, donations, government funding, grants and subsidies, and non-operating income.	Cross-cutting sectors (excluding tourism) Statistics NZ, Annual Enterprise Survey statistics, custom job.

Sources: economic data

The following sources were used for economic data

Metric	Source for standard ANZSIC sectors	Source for tourism	Source for high & medium-high technology manufacturing
Nominal GDP	Statistics New Zealand, Infoshare Database, System of National Accounts 1993, SND, GDP(P), Nominal, Actual, ANZSIC06 industry groups (Annual–Mar).	Statistics NZ, Tourism Satellite Account: 2012, Table 1 Tourism expenditure by component, Direct tourism value added.	Statistics NZ, value added estimates from customised Annual Enterprise Survey tables. Note: this data has not been through the System of National Accounts, so is indicative only.
Real GDP	Statistics New Zealand, Infoshare Database, National Accounts, System of National Accounts 1993, SND, GDP(P), Chain-volume, Actual, ANZSIC06 industry groups (Annual–Mar). Adjusted so that 2010 real GDP = 2010 Nominal GDP. Does not incorporate revisions published by Statistics NZ in December 2012.	n/a	
Goods exports	Statistics NZ, merchandise exports, obtained by matching commodities to the ANZSIC06 industry that characteristically produces them. Note: sector exports values will exclude items suppressed in accordance with Statistics NZ's confidentiality policy. For more information, see http://www.stats.govt.nz/about_us/policies-and-protocols/trade-confidentiality.aspx		Statistics NZ, merchandise exports, obtained by matching commodities to the ANZSIC06 industry that characteristically produces them

Sources: economic data *continued*

Metric	Source for standard ANZSIC Sectors	Source for tourism	Source for high & medium-high technology manufacturing
Employment	Statistics New Zealand, Table Builder, Linked Employer-Employee Data (LEED) Tables (annual), Table 1.6: Main Earnings Source by Industry (NZSIOC).	Statistics NZ, Tourism Satellite Account: 2012, Table 4, Direct employment in tourism (FTEs) and Employment (FTEs) in tourism as a percentage of total. See http://www.stats.govt.nz/browse_for_stats/industry_sectors/Tourism/tourism-satellite-account-2012/tourism-employment.aspx for more information on the tourism FTE measure.	Statistics NZ, LEED, custom job.
Productivity	Real GDP divided by hours paid. Hours paid data from Statistics NZ, Infoshare Database, Productivity Input Series – Industry Level (ANZSIC06) (Annual–Mar), Hours, Gross. Manufacturing hours paid for 2010 split into manufacturing sub-sectors using QES hours paid and rated back using productivity indexes from Statistics NZ.	Substituted nominal GDP per employee.	Substituted nominal value added/employment.
Investment in fixed assets	Statistics New Zealand, Infoshare database, System of National Accounts 1993 – SND, Series, GDP(E), Nominal, Actual, Asset type (Annual–Mar), Gross Fixed Capital Formation.	Statistics NZ, Tourism Satellite Account – TSA, Table: Gross Fixed Capital Formation by Asset Type and by Industry (ANZSIC06) (Annual–Mar). Note: data only available for certain years up to 2009.	Statistics NZ, Additions less disposals of fixed assets from customised Annual Enterprise Survey tables. Note: this data has not been through the System of National Accounts, so is indicative only. The all sector total excludes some industries – see note on the following page.
Number of firms	Statistics NZ Table Builder, Business Demography Statistics, Detailed Industry for Enterprises, number of enterprises.	n/a	Customised Business Demography Statistics, number of enterprises.

Sources: financial data

The following sources were used for financial data

Metric	Source for standard ANZSIC Sectors	Source for tourism	Source for high & medium-high technology manufacturing
Surplus per employee	Statistics NZ, Annual Enterprise Survey release, surplus per employee count. The all sector total excludes some industries – see note below.	n/a	Statistics NZ, Customised Annual Enterprise Survey data, surplus per employee count.
Return on equity	Statistics NZ, Annual Enterprise Survey release, return on equity. Total excludes some industries – see note below.	n/a	Statistics NZ, Customised Annual Enterprise Survey data, return on equity.
Debt ratio	Statistics NZ, Annual Enterprise Survey release, total liabilities (current and other) divided by total assets. The all sector total excludes some industries - see note below.	n/a	Statistics NZ, customised Annual Enterprise Survey data, total liabilities (current and other) divided by total assets.
Capital stock per worker	Statistics NZ, National Accounts (Industry Benchmarks): Year ended March 2010, Table 14 Net capital stock by industry, current prices (replacement cost), 1987–2010, divided by employment.	Statistics NZ, Tourism Satellite Account, capital stock, divided by employment. Note: capital stock data is only available for some years up to 2009 and does not incorporate the National Accounts revisions published in November 2012.	Substituted with fixed assets per worker from Statistics NZ, Customised Annual Enterprise Survey data, fixed tangible assets divided by employment. Note: the fixed assets data has not been through the System of National Accounts, so is indicative only. The all sector total excludes some industries – see note below.

Note: AES data excludes residential property operators, foreign government representation, religious services, private households employing staff and superannuation funds.

Sources: Business Operations Survey, example firms, and others

Business Operations Survey

The Business Operations Survey collects information on the operations of New Zealand businesses. This information is used to quantify business behaviour, capacity and performance. The survey gives insights into business activities, barriers, and motivations, and the effects behind New Zealand business operations.

Data from the Business Operations Survey was used to calculate barriers to exporting and innovation, innovation and R&D rates by sector; the rate of outward direct investment and foreign direct investment by sector, and percentage of firms in a sector reporting overseas income.

Size of Business Operations Survey

The survey is run annually and typically information is collected from approximately 36,000 firms operating in New Zealand with six employees or more.

Customised data for the Sectors Report

Data for the cross-cutting sectors (information and communications technology, high technology manufacturing, tourism, and knowledge intensive services) and some of the manufacturing sectors was provided by Statistics NZ as a custom job. This data may be below the level the survey is designed for and so should be treated with caution.

Detailed information on the Business Operations Survey is available from www.stats.govt.nz

Example firms: sources and limitations

The example firms are sourced from the Kompass database, Management Magazine's top 200 firms (2012), plus various websites, annual reports and the TIN 100 publication (2012).

Firms allocated to sectors in this report may not match firms included in official statistics. Statistics NZ does not release firm level data. In most cases numbers employed and turnover quoted for example firms are estimates.

MBIE welcomes corrections to the data for the example firms.

Other sources

Other data sources, such as the Comtrade database, are noted on the page on which they occur.

Export data limitations

This report attributes exports to sectors by mapping products and services to the sector most likely to produce them

Classifying exports by sector

Statistics on exports are collected according to product or service type and not according to the sector that generates the exports.

Statistics New Zealand collects goods trade statistics using the New Zealand Harmonised System Classification 2012 (NZHSC). This is based on the World Customs Organization's (WCO) Harmonized Commodity Description and Coding System (HS).

Firms are classified into sectors using the Australian and New Zealand Industrial Classification (ANZSIC) system.

To obtain insight into the export performance of sectors for this report, Statistics New Zealand prepared a concordance that maps HS codes (how goods exports are classified) to ANZSIC codes (how sectors are classified).

This concordance allocates exports to sectors based on the **type of product the sector is most likely to produce**. Hence, logs and fruit are attributed to the agriculture, forestry & fishing sector, while sawn wood products are attributed to the wood & paper sector, and milk powder and frozen beef are attributed to food & beverage manufacturing.

Treat with caution

The export data for sectors provided in this report is believed to be broadly correct, but should be treated with caution. The method used means that some sectors which clearly do export, have no or few exports allocated.

The clearest example is the wholesaling sector. Many wholesalers operating in New Zealand export products on behalf of the producers of those products, or purchase and on-sell them overseas. These exports are attributed to the sector that manufactured, grew, harvested or mined them, rather than to the wholesaling sector. Experimental data from Statistics New Zealand indicates that the value of goods exports by wholesale trade firms was around \$8b in 2011.

Services exports

Statistics New Zealand publishes services exports data by service type as part of its balance of payments statistics every quarter. These are calculated using a variety of different surveys and administrative data sources.

In this report, we have allocated exports of transportation, insurance and government services not included elsewhere to the logistics, finance & insurance, and government sectors, respectively.

Commercial services by sector came from an industry breakdown from the Census of International Trade in Services and Royalties: Year ended June 2011 (not available for 2012).

There is no breakdown of travel exports by sector. Travel exports include all spending on goods and services by non-resident visitors to New Zealand. It overlaps considerably with tourism exports, but includes spending by international students here for more than a year as well as those here for up to a year (whereas tourism only includes those here for up to a year) and excludes tourists' international airfares (which are included in tourism, but are part of transportation exports in the balance of payments).

Further reading: information on the New Zealand economy

Publication	Available from
<p>The Regional Economic Activities Report, 2013 The Regional Economic Activity Report presents available official economic data on New Zealand's 16 regions. The report, which will be annual, provides regional economic information sourced from a number of government agencies.</p>	<p>www.mbie.govt.nz</p>
<p>Situation and Outlook for Primary Industries (SOPI) 2012 This report provides up-to-date information about the performance of New Zealand's primary sectors – dairy, meat and wool, forestry, horticulture, arable and, for the first time, seafood – and gives independent forecasts of future prospects.</p>	<p>www.mpi.govt.nz</p>
<p>The Food and Beverage Information Project reports The project pulls together all the available information on the food and beverage industry into one place, in a form which is familiar and useful to business. Over 20 reports are available on every aspect of New Zealand's food industry, including information on export market and investment opportunities. New and updated reports are released annually.</p>	<p>www.foodandbeverage.govt.nz</p>



Further reading: Business Growth Agenda reports

Publication	Available from
Building innovation The building innovation work stream of the Business Growth Agenda aims to grow New Zealand's economy by encouraging and enabling investment in research and development, and lifting the value of public investments in science and research.	www.mbie.govt.nz
Export markets The export markets work stream of the Business Growth Agenda aims to increase exports by New Zealand businesses, which is necessary to lift New Zealand's economic growth and living standards.	www.mbie.govt.nz
Building infrastructure The building infrastructure work stream of the Business Growth Agenda aims to provide the physical platform that will support sustained economic growth.	www.mbie.govt.nz
Natural resources The building natural resources work stream of the Business Growth Agenda aims to make better use of New Zealand's abundant natural resources, so we can continue to grow our economy and look after our environment.	www.mbie.govt.nz
Skilled and safe workplaces The skilled and safe workplaces work stream of the Business Growth Agenda aims to improve the safety of the workforce and build sustained economic growth through a skilled and responsive labour market.	www.mbie.govt.nz
Building capital markets The building capital markets work stream of the Business Growth Agenda aims to ensure New Zealand has high performing capital markets that support investment, growth and jobs.	www.mbie.govt.nz

The Ministry of Business, Innovation & Employment (MBIE) welcomes comment and feedback on this report, and on the measures the Government is taking to facilitate the development of competitive and successful high and medium-high technology sectors.

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