Derwent™

A Clarivate Analytics company

Survey of New Zealand Patent Activity

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EXECUTIVE SUMMARY

COMPARISON OF DOMESTIC AND FOREIGN NEW ZEALAND PATENT ACTIVITY

Analysis of patents filed in New Zealand by foreign applicants showed that the inventions chosen for filing in New Zealand are very high value in nature – i.e. the patents have very high levels of grant success (over 81%) and have been on average filed in more than 11 patent issuing jurisdictions. This represents a slight increase from the original report conducted in 2011.

A larger trend seen in this report, however, is a dramatic decline in publication[1] across all technical domains. This is seen beginning in 2013, and the decline continues through the final complete publication year in the study, 2019. In several measured categories, there does appear to be a slight rebound in publication in 2019, but it is premature to consider this a trend.

It is deduced that foreign applicants choose to file in New Zealand as part of achieving wide global protection for their invention. These inventions can therefore be described as "strategic" in nature; high grant success rates would be expected to follow due to the strong prosecution of the application at each authority, i.e. through prompt and robust responses to office actions, and thorough inventions disclosure vetting and greater attention paid to them by in house and retained patent professionals.

In this light, it is unfair to directly compare foreign New Zealand patents to domestic activity as the domestic patents are unlikely to have benefitted from the same level of investment of time and money.

A review of the levels of grant success of domestic New Zealand patents at multiple international offices (US, Europe and Australia) indicates a high level of grant achievement[2].

Patent activity from the Academic Sector in New Zealand produces notably higher levels of patent grant success, and scores more highly across the board compared to overall domestic activity. The academic patents are generally more widely protected geographically, indicating that it is a particularly high-quality source of potentially commercializable technology. NZ academic patents are filed quadrilaterally at more than twice the rate of NZ domestic filing at nearly 16%.

Indeed, the Universities of Auckland and Waikato and CRI's AgResearch, and Industrial Research Limited all qualify for the list of most prolific New Zealand patent entities.

TECHNICAL NATURE OF PATENT APPLICATIONS IN NEW ZEALAND

The majority of patents filed by ***foreign patent applicants*** concern pharmaceutical therapies. These patents make up nearly half of the total applications submitted to the Intellectual Property Office of New Zealand. Of the top 20 largest global companies filing in New Zealand in the past 2 decades, 16 companies are pharmaceutical or medical technology entities.

[1] Patent applications that are published and publicly available are analyzed in this report.
[2] Grant success of New Zealand domestic patents in Australia is 67%, USA is 73% and at the EPO is 79%.

The only corporations in the top 16 foreign filing assignees not in the pharmaceutical industry are BASF, Qualcomm, ITW and Dow. A previous top foreign entity, Microsoft, still appears to be active in New Zealand, but has fallen to 30th overall in the collection.

Nearly all of the pharmaceutical patents applied for in New Zealand have previously undergone examination in another patent authority.

New Zealand ***domestic patent applicants*** continue to file heavily in technologies such as Agriculture and Food, Industrial Engineering, and Civil Engineering, specifically building materials. This pattern of technologies implies that New Zealand patent activity focuses primary industries, with a specific specialisation in food products. It is perhaps not surprising for New Zealand entities to be heavily concentrated in physical commodities such as domestic appliances, construction materials and other heavy equipment, given the logistical challenges of shipping such items to an isolated nation.

This specialization reflects the nature in the most prolific domestic applicants: companies such as Fonterra, Gallagher, and Carter Holt Harvey and CRIs such as AgResearch.

Domestic applicants perform high levels of international patent filing in 6 main fields:

- Industrial Engineering
- Pharmaceuticals
- Agriculture and Food
- Domestic Articles and Personal Care products
- Materials Science
- Civil Engineering

Therefore, these industries and sciences can be considered of strategic importance to New Zealand entities.

GEOGRAPHICAL ANALYSIS OF NEW ZEALAND PATENT ACTIVITY

Generally, New Zealand entities appear to have little interest in filing for patent protection in Asia Pacific outside of neighbouring Australia. Conversely, Japan. South Korea and China are the fastest growing larger (300+ inventions) source of foreign NZ patent applications, perhaps confirming the observation from the prior report that Asia Pacific is taking an interest in New Zealand as a market. The fastest recent growth – albeit from a very low base – is coming from Brazil, Norway, Taiwan and Belgium. India, previously cited as a possible source of growth for New Zealand, shows a decrease beyond the previously mentioned overall decline in publication.

The exception to this international reticence comes from the New Zealand academic sector, which shows a recent recovery in the number of patent applications in many countries, including China, Indonesia, Vietnam, and The Philippines.

New Zealand's strongest patent ties appear to be with Australia, the USA and the UK; locations to which New Zealand has strong cultural, historic, linguistic and economic ties.

Australia is by far the most common co-applied country for patents that are filed in New Zealand by foreign applicants – almost to the point of ubiquity. 96% of patents filed in New Zealand by foreign applicants are also filed in Australia.

NEW ZEALAND ACADEMIC PATENT ACTIVITY

Academic patent output is concentrated into 5 fields of study:

- Pharmaceuticals
- Agriculture and Food
- Biotechnology
- Measurement and Information
- Materials Science

These trends align closely with the technical representation seen in the previous report. Other strong fields include:

- Computing and IT
- Medical Technology
- Chemical Engineering

As with other recent trends, it is difficult to draw conclusions about the growth of specific technical fields. There does seem to be stronger recent recovery (in 2018 and 2019) in Pharmaceuticals, Biotechnology, and Agriculture and Food. Smaller fields, including Water Treatment, Electrical Devices, and Petroleum show higher recent growth, but the largest of these categories (Electrical Devices) only represents 21 inventions over the past two decades, so this is not a conclusion to bank on.

Geographically, New Zealand academic institutions habitually file for patent protection in Australia and the United States (in addition to New Zealand). This pattern of filing behaviour appears to be linked to the attempt to license patents at a later date, as US granted status is usually a prerequisite to successful patent commercialization. In fact, the US is now the most common foreign filing country for New Zealand academic institutions, surpassing Australia. It is unknown whether this reflects recent interest in the US market, or is dependent upon market extension of older patents.

As noted earlier, New Zealand academic institutions have recently shown increased interest in Chinese patent filings – principally from AgResearch, and the Universities of Auckland and Waikato. Canada also appears to be of key importance for the New Zealand Institute for Plant Food and Research and Otago University.

2 of the top 5 academic institutions within New Zealand are Crown Research Institutes (CRI) – highlighting the successful nature of these entities in producing commercializable technology directly from government support.

The most prolific institution is the AgResearch Crown Research Institute, followed by the University of Auckland. This repeats the observation seen in the previous study.

However, profligacy in patent activity does not appear to equate with patent commercialization success. Measurement of commercialization outcomes and quality measurement of each institution's patents results in a benchmark that is set by the New Zealand Dairy Board, Otago University, as well as the University of Auckland.

The Crown Research Institutes do appear to show an overall improvement from the previous study, when quality measurements such as filing breadth, collaboration and citation are taken into account. Two of the top 5 entities in overall range are CRIs, with AgResearch second overall, and the New Zealand Institute for Plant & Food Research third. In the 2011 report, only AgResearch appeared in the overall top 5, at fifth position. A more detailed analysis of quality and breadth of the patents is provided in part 4 of this report which discusses Derwent Strength Index (dsi) of applicants.

SUMMARY CONCLUSIONS

The three groups of patent applicants compared in this study appear to have different motivations when it comes to filing patents.

Foreign applicants file in New Zealand only as part of wide global filing of high valuable and strategic patents. The most obvious case study of this strategic filing is the very large proportion of foreign applications in the pharmaceutical sector. As previously speculated, this is likely due to the non-insubstantial costs of shipping large items to New Zealand.

New Zealand academic applicants file patents in order to pursue commercialization opportunities – i.e. successful technology transfer. In doing so, they file habitually in Australia and United States.

Apart from notable exceptions, domestic applicants appear to be more regional in focus, filing mostly in New Zealand and Australia. This regional focus means that the patent activity from domestic entities scores poorly on patent quality metrics.

Domestic activity also focuses on the primary industries: e.g. building materials, agriculture and food technology. However, patent activity in biotechnology and pharmaceuticals is growing quickly, indicating that these industries may well eclipse the industrial engineering activities in the next few years.

The largest overall trend in this study is the significant decline in patent activity in recent years. As will be discussed in more detail throughout the report, this is likely a direct result of the substantial changes to New Zealand patent law, moving the nation to the international standards of absolute novelty, rather than the prior local novelty requirement. While this brings New Zealand into alignment with nearly all other patent offices, the significant resources this requires is likely causing a substantial backlog of patent prosecution. The most recent years seem to suggest that investments made in IPONZ are enabling a more timely process, but it remains to be seen how this change will impact future trends.

INTRODUCTION AND OBJECTIVES

This report was commissioned by the Intellectual Property Office of New Zealand to investigate the nature and source of patent filing activity in New Zealand.

The report looks at three major sources of patent activity:

- Activity filed in New Zealand, from a foreign source
- Activity filed in New Zealand, from a domestic New Zealand source
- Activity filed in New Zealand and attributable to a New Zealand academic institution or Crown Research Institute

Using these three sources, and measuring them against properties such as volume, technical nature and patent quality metrics, a good understanding of the nature of patent activity in New Zealand can be ascertained. This report is a continuation of a report delivered in 2011, and replicates much of the methodology and work completed then.

DATA SOURCES

The report uses the ***Derwent World Patents Index***^{TM}, a database produced by Clarivate Analytics, as the sole source of patent information regarding New Zealand. This database covers New Zealand examined patent applications and granted patents published from 28th October 1992 to the present day.

DATA CREATION METHODOLOGY

The survey has been performed on a DWPI-based patent collection defined by the following parameters:

- DWPI record containing a New Zealand examined publication
- Where the patent family[3] contains an earliest priority[4] filing date on or after 1 January 2000, from any patent authority included in the DWPI database.

Once the dataset was finalized, various data formatting and cleaning methodologies were applied to it so that fair and accurate analysis could take place. These steps included:

- Normalizing assignee names (though no research of subsidiaries or ownership took place)

[3] A single patent only provides a statutory monopoly for the patented technology within the legal jurisdiction of the authority that granted the patent. This means that inventors must file applications for a patent in each jurisdiction where they foresee a need for protection. A patent family therefore describe the collection of patent applications and granted patents that gather for a single invention as it is filed in different legal jurisdictions.

[4] Priority refers to the first application for a particular invention which when filed at any patent office becomes the "priority application", with the date of this event defining the priority date. The patent office location of the first filing is defined as the priority country. The priority filing provides the patent applicant with a grace period to file on the same invention in other patent jurisdictions without loss of the "novelty" requirement for patentability.

- Categorization of the collection into technical disciplines, e.g. telecommunications, agriculture & food etc.
- Separation of patents associated with New Zealand academic institutions.

CONVENTIONS AND DEFINITIONS

PATENT COUNTING

The DWPI database is structured around patent families.

Each related patent application and granted patent is added to the DWPI family record as it is published. This being the case, all counts of records in this project refer to patent families or inventions, and not to individual patent documents. For example, the European application, European granted patent and the US granted patent for a single invention family is counted as "1" in all the analyses in this report unless otherwise noted.

This provides a more accurate measure of the level of inventive activity.

TIMELINE AND DATES

As each DWPI record contains potentially many individual application and publication events, this report uses either the earliest known priority filing date for each patent family, or the publication date of the patent family member in New Zealand.

The tables and charts included in the report use these dates unless otherwise noted.

FOREIGN AND DOMESTIC PATENT SOURCES

The survey requires the distinction between patent activity filed in New Zealand that is foreign or domestic in nature.

Determination of the specific geographical location of each patent applicant is not possible on such as wide scale; therefore, some simple but accurate assumptions were used to define the source of New Zealand activity.

- "Foreign" activity, i.e. New Zealand patent filing activity that is based on innovation performed outside of New Zealand, is defined by New Zealand patent publications that claim priority outside of New Zealand, i.e. in any other patent jurisdiction. [5]
- "Domestic" activity, i.e. New Zealand patent filing activity based on innovation performed by New Zealand-resident individuals or entities, is defined by New Zealand patent publications that claim priority in New Zealand.[6]

TABLE VISUALISATIONS

Many tables in the report are sorted by a specific column, and for ease of understanding this column is highlighted by grey coloration, e.g.:

NZ Domestic Filing Entity	Total Patents also Filed in Australia	% of Activity also Filed in Australia

Indicates that the table is sorted by the "% of Activity also Filed in Australia" column.

[5] Foreign activity is determined from priority country. A patent claiming USA as a priority country and then having subsequent filing in NZ, will included under "foreign activity.

[6] Inventor location/country is used as a proxy for domestic activity.

PART 1 – SUMMARY OF NEW ZEALAND PATENT ACTIVITY

INTERNATIONAL COMPARISON OF NEW ZEALAND PATENT ACTIVITY

The number of patented inventions with a New Zealand publication event and with an earliest priority date of January 1st, 2000 is 54,569.

This figure alone does not really allow much international comparison, as other nations have varying levels population and wealth; as well varying levels of research and innovation output.

The table below places New Zealand amongst a select group of comparable nations to provide an international comparison of the level of patent activity in New Zealand, as a function of the overall wealth of the nation, as defined by nominal GDP in 2018.

International Comparison of New Zealand Patent Activity

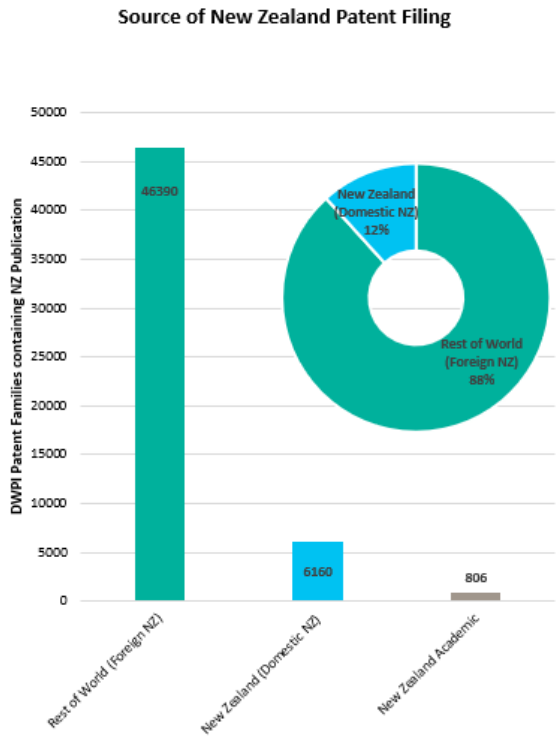
DWPI Families with Publication Event in Country, Earliest Priority 2000 to Present

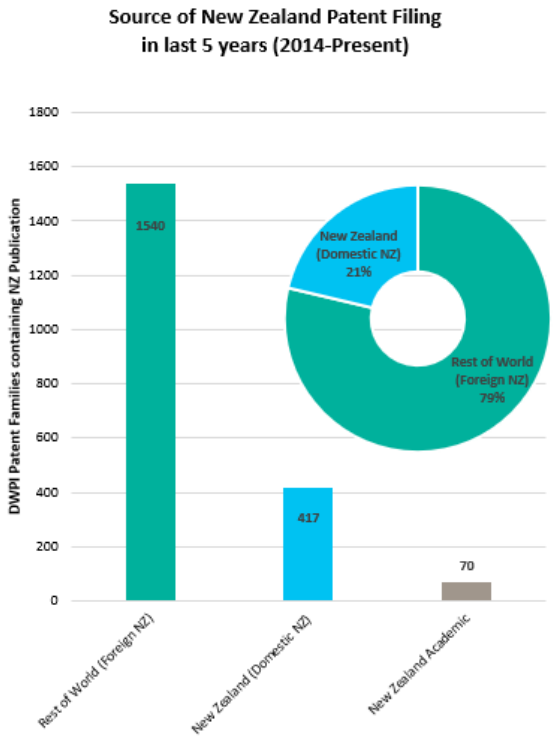
Nation	Patent Publication Events (Domestic)	GDP (2018 Nominal; Source: World Bank) (millions US$)	Domestic publications per million US dollars GDP
South Korea	388,313	$ 1,619,423	0.24
Japan	893,904	$ 4,971,323	0.18
Germany	567,603	$ 3,947,620	0.14
France	262,529	$ 2,777,535	0.09
Finland	24,239	$ 276,743	0.09
United Kingdom	203,187	$ 2,855,296	0.07
China	916,029	$ 13,608,151	0.07
Sweden	36,749	$ 556,086	0.07
Australia	79,590	$ 1,433,904	0.06
Brazil	103,573	$ 1,868,626	0.06
Hungary	8,652	$ 157,882	0.05
Czech Republic	13,244	$ 245,228	0.05
India	135,644	$ 2,718,732	0.05
United States	947,706	$ 20,544,343	0.05
Netherlands	34,209	$ 913,658	0.04
New Zealand	6,160	$ 204,923	0.03
Canada	40,081	$ 1,713,341	0.02

FOREIGN VERSUS DOMESTIC ACTIVITY

Most patents filed in New Zealand come from overseas. The chart below shows that out of nearly 55,000 patents filed in New Zealand, 88% originate in another territory.

This leaves approximately 12% of New Zealand activity attributable to New Zealand-based patent applicants, a decline from approximately 17% in the previous study. The chart on the right shows source New Zealand patent filing activity in the last 5 years (since 2014).





TIMELINE OF PATENT ACTIVITY

Typically, patent analytical techniques rely on the first, or priority, filing event to provide a closest possible measurement of the moment of innovation.

However, in the case of analyzing New Zealand patent activity, the earliest priority date within a patent family provided a poor data point for trend comparison.

The chart below left shows the activity in New Zealand from 2000 to present, based on the overall collection parameter of DWPI patent families first filed on or after January 1st, 2000.

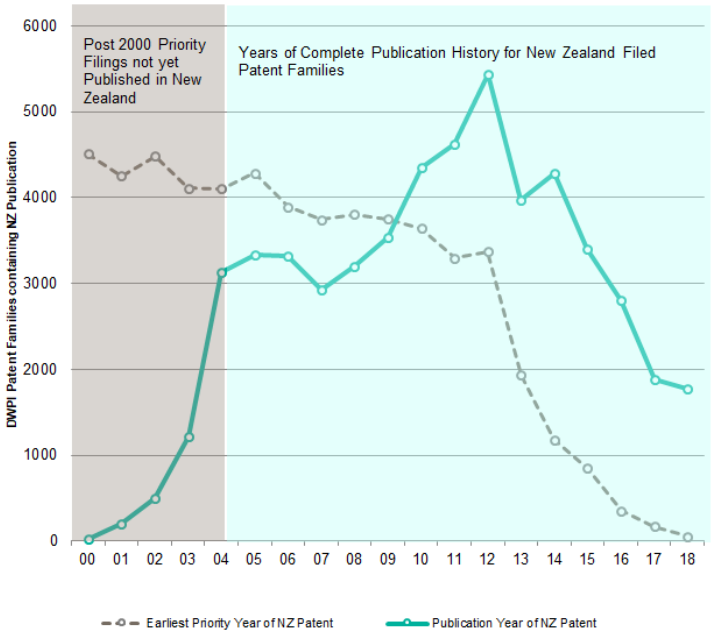
Displayed on the chart is both the timeline as measured by earliest priority (dotted grey) as well as the timeline based on the date of publication of the examined New Zealand application.

Both charts show distinct trends, which on further investigation point to a specific characteristic of New Zealand patent applications. There is a long 4-5 year lag between a priority filing occurring somewhere in the world and the subsequent publication of that invention if filed in New Zealand.

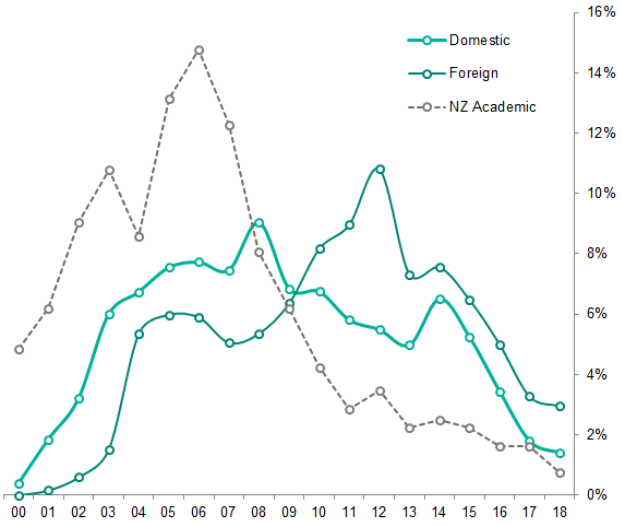
The delays included in this lag period would include the 12-month period during which worldwide patent application can take place; the length of time for examination in New Zealand and the 18-month delay between application and patent publication.

Together these mean that the New Zealand publication date is the most reliable indicator of patent activity for this survey.

Timeline of New Zealand Patent Filing



Timeline of New Zealand Patent Filing by Source



Viewing these metrics, the timelines show a decline in academic publishing, while foreign publishing seems to be following the decline noted previously.

On 13 September 2014, the Patents Act 2013[7] went into effect. This action introduced a significant change to the way patent prosecution was handled in New Zealand. Under previous regulation, introduced in 1953, New Zealand was nearly unique in the way that

[7] http://www.legislation.govt.nz/act/public/2013/0068/latest/DLM1419043.html

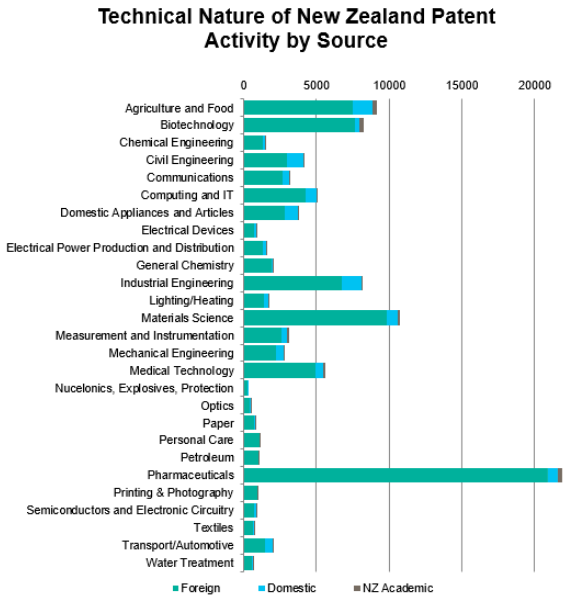
novelty was defined. Globally, in order to qualify for patent protection, one filing for patent protection had to demonstrate absolute novelty of the invention to be protected. This meant that any prior art, from any jurisdiction, could be a disqualifying matter preventing the grant of a patent. In New Zealand, inventions merely had to meet *local* novelty. This disregards any publication or use outside that particular jurisdiction. Local novelty "worked" in such an age because it provided an incentive to bring technology, be it new or known elsewhere, to a developing country such as New Zealand was at the time. Not only this, but given New Zealand's geographic isolation, there was also a sound argument that anyone prepared to go to these lengths in order to import a new technology may be deserving of a monopoly right upon it.

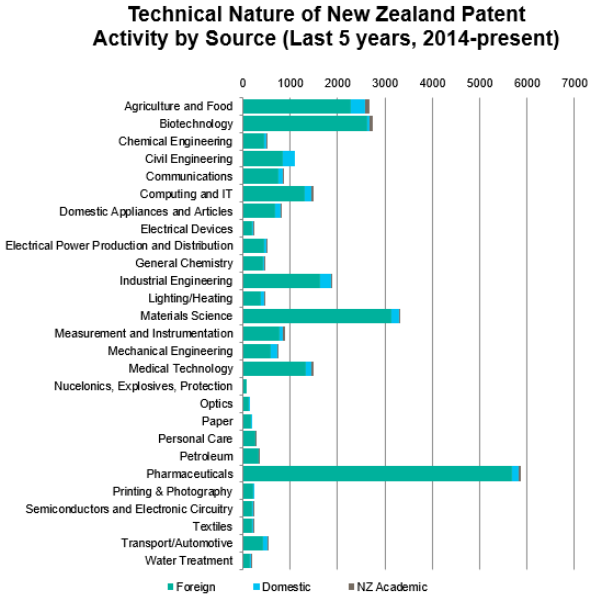
As such, if New Zealand patents are indeed more difficult to obtain under the provisions of the new Act – and we've now had a four-year sample suggesting that this is indeed the case, then this is most likely attributable to the incoming inventive step and support requirements (and the stringency with which these are being maintained during examination) rather than the shift from local to absolute novelty[8].

It is suspected that this significant change in patent requirements has caused much of the observed decline in patent publications, and that there is likely a significant increase in pendency due to increased workload.

ANALYSIS OF THE TECHNICAL NATURE OF NEW ZEALAND PATENT ACTIVITY

The 55,000 New Zealand patent publications were categorized into a high-level taxonomy describing the general technical field of each invention. These categories are not mutually exclusive, i.e. a single patent family can be associated with multiple fields. For example, a patent regarding computational analytical software for proteomics would be included in both the 'Biotechnology' and 'Computing and IT' disciplines.





[8] https://www.lexology.com/library/detail.aspx?g=46b0688a-f6a0-4d24-9e66-4f2027329d5d

The chart on the left shows the number of inventions published in New Zealand during the survey period associated with each of the technical fields. The chart on the right shows the number of inventions published in New Zealand in last five years (2014 to present) associated with each of the technical fields

Also included on the chart is an indication of the split of activity between New Zealand domestic applicants, foreign applicants and patents associated with NZ academic institutions.

The largest technical field is pharmaceuticals, primarily due to the large number of patents filed by foreign applicants in this field. This is followed by patents associated Materials Science, Agriculture and Food, and Biotechnology. The last 2 fields show a high level of domestic interest as well as international interest.

In addition to these fields, other concentrations include:

- Industrial Engineering
- Medical Technologies
- Computing and IT

THEMATIC CONCEPT MAP OF NEW ZEALAND PATENT ACTIVITY

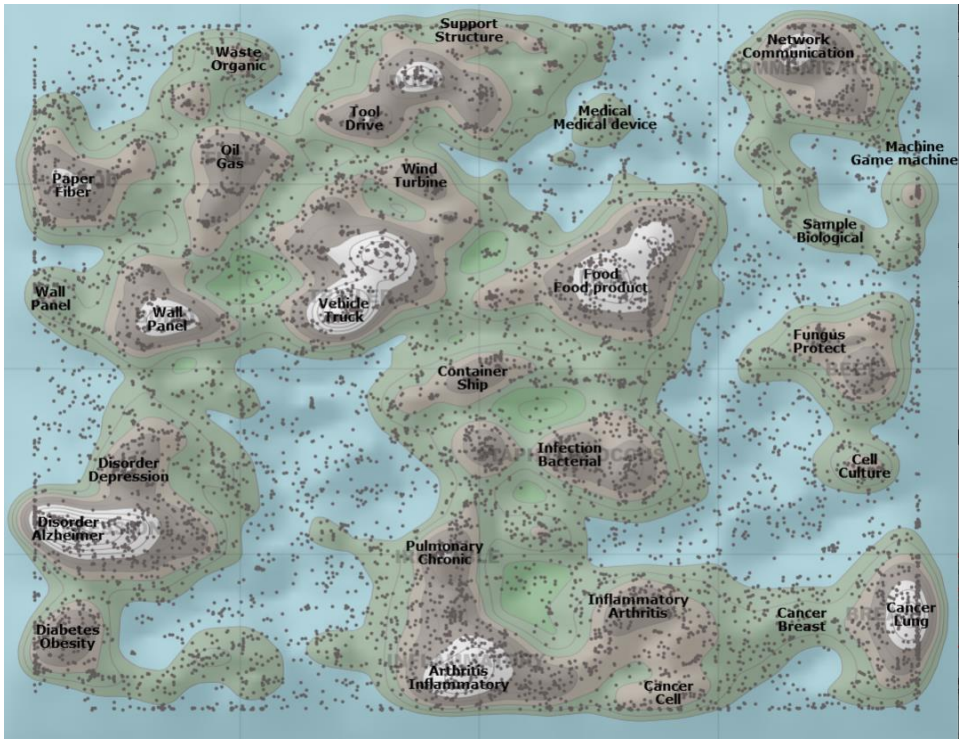
Another method of visualising the technical nature of recent New Zealand patent activity is to use concept mapping.

The figure on the following page shows output from the Clarivate Analytics ThemeScape™ tool. This tool allows the analysis of large patent collections, and compares the frequency and proximity of terminology; displaying the results of this analysis in a two-dimensional landscape.

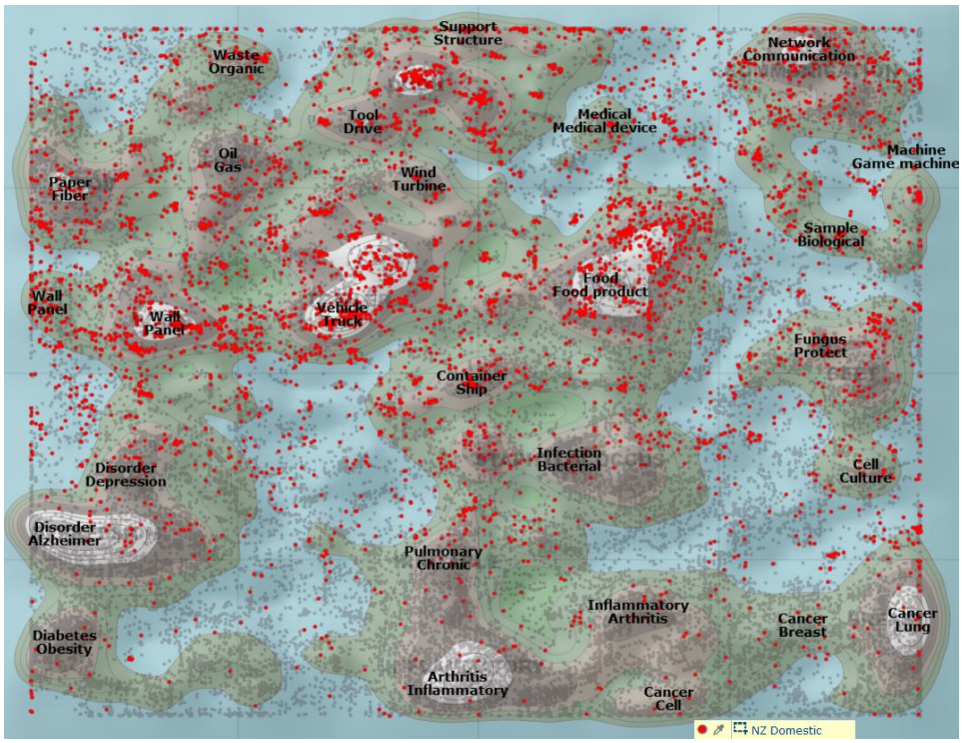
Each patent family or "invention" is situated in a single location on the landscape map. Areas of higher density (i.e. the mountainous regions – gray areas) represent technical topics shared across many inventions – and therefore of greater interest. Some common technology themes in peaked regions are labelled in black letters.

The ThemeScape maps below summarise the major concepts and subject matters within the entire NZ collection of approximately 55,000 patent families in the patent collection.

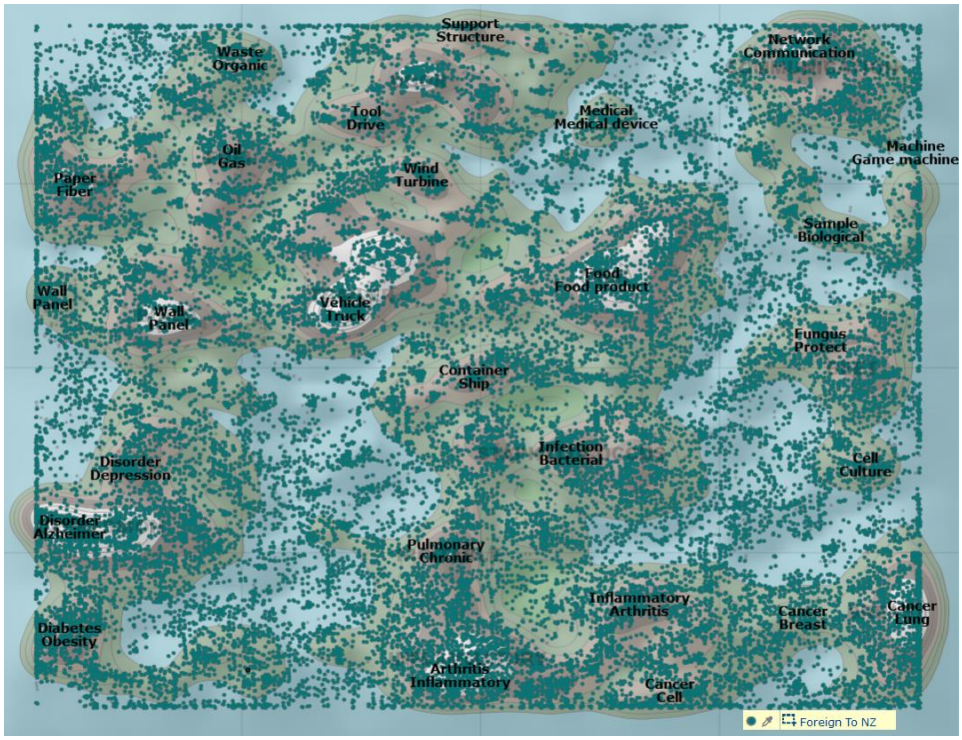
The first map displayed represents the entire NZ collection and shows all inventions as grey dots. The lower portion of the map appears to be a large region heavily involved in medical and pharmaceutical innovation. The upper right region is predominantly computer and network technology. Near the center of the map is a peak representing food technologies, and the upper left region demonstrates a more "catch-all" section, including building materials, automotive technologies, paper making, shipping, tools, and petroleum technology.



The next map highlights the New Zealand domestic patents (red dots). It indicates that the predominant technologies originating in New Zealand are heavily concentrated in food-based technologies, computer and networking technologies, and construction disciplines. There are also concentrations in many of the pharmaceutical peaks.



The next map highlights the patents originating outside of New Zealand. This visual provides a clear understanding of the international nature of the pharmaceutical patents inbound into New Zealand from abroad. These patents make up approximately half of IPONZ's workload (and therefore the bulk of the effort).



TIMELINE OF TECHNOLOGIES PATENTED IN NEW ZEALAND

The table below shows the timeline of patent activity (as measured by the year of publication of the patented invention in New Zealand) for each of the technical disciplines.

Also included in the table are the total number of inventions in each category. Because of the past decade decline in publishing seen based on changes in patent law, a calculation of rates of growth/decline would demonstrate a decline across all categories. Because of this, it may be more instructive to consider the data in a normalized manner.

Timeline of NZ Patent Activity by Technical Field
Excludes Incomplete Years (volume)

Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total All Years	% Recency (since 2014)
Agriculture and Food	525	541	507	412	518	579	647	780	1,010	693	729	610	536	329	269	321	9,006	31%
Biotechnology	352	415	395	275	587	640	499	618	1,090	636	726	649	602	418	340	357	8,599	36%
Chemical Engineering	69	70	85	71	71	93	115	147	146	124	148	124	116	39	41	64	1,523	35%
Civil Engineering	233	264	305	273	259	259	314	324	290	307	326	271	185	131	125	119	3,985	29%
Communications	209	209	190	190	235	178	253	219	275	260	269	188	119	79	95	133	3,101	28%
Computing and IT	242	298	329	325	378	277	351	372	459	465	463	340	235	171	163	197	5,065	31%
Domestic Appliances and Articles	323	275	317	289	252	235	259	271	252	214	272	178	143	83	85	82	3,530	24%
Electrical Devices	49	46	44	59	66	73	65	71	86	66	66	55	28	26	22	26	848	26%
Electrical Power Production and Distribution	67	78	87	71	76	84	128	137	152	155	140	128	98	65	34	61	1,561	34%
General Chemistry	154	158	139	94	105	127	195	204	267	138	159	112	78	34	43	48	2,055	23%
Industrial Engineering	610	651	645	596	486	523	631	598	570	506	557	415	324	213	213	197	7,735	25%
Lighting/Heating	119	108	130	104	100	95	99	127	123	139	166	100	64	49	41	56	1,620	29%
Materials Science	510	550	558	515	528	584	901	1,056	1,199	869	950	746	618	434	390	393	10,801	33%
Measurement and Instrumentation	151	156	195	188	209	226	235	280	337	223	261	250	170	106	94	109	3,190	31%
Mechanical Engineering	188	181	185	193	155	141	201	230	213	213	214	165	120	91	77	82	2,649	28%
Medical Technology	345	360	369	325	360	395	513	430	555	380	460	320	246	200	199	210	5,667	29%
Nucelonics, Explosives, Protection	21	17	22	14	12	12	17	19	30	18	32	14	8	6	7	9	258	29%
Optics	32	33	19	32	16	29	34	33	36	32	34	30	29	16	20	28	453	35%
Paper	62	76	63	40	46	32	85	73	77	57	66	47	23	15	14	20	796	23%
Personal Care	71	58	56	47	58	64	93	143	159	97	84	64	46	36	33	51	1,160	27%
Petroleum	54	68	63	45	44	50	76	91	142	69	107	87	61	28	30	32	1,047	33%
Pharmaceuticals	1,271	1,368	1,333	1,064	1,337	1,530	1,826	2,050	2,684	1,502	1,660	1,405	1,296	859	775	821	22,781	30%
Printing & Photography	72	75	67	59	44	38	116	88	94	49	52	60	37	27	24	28	930	25%
Semiconductors and Electronic Circuitry	28	48	51	54	55	48	73	80	99	88	84	44	30	29	16	30	857	27%
Textiles	39	43	56	35	24	37	48	65	72	59	65	49	36	24	22	26	700	32%
Transport/Automotive	128	135	136	132	108	114	163	163	149	144	167	106	90	66	68	49	1,918	28%
Water Treatment	35	39	37	34	23	39	44	66	59	49	64	30	21	24	16	21	601	29%

Above average recency

The same data above is presented here in a time-normalized view:

Timeline of NZ Patent Activity by Technical Field
Excludes Incomplete Years (normalized)

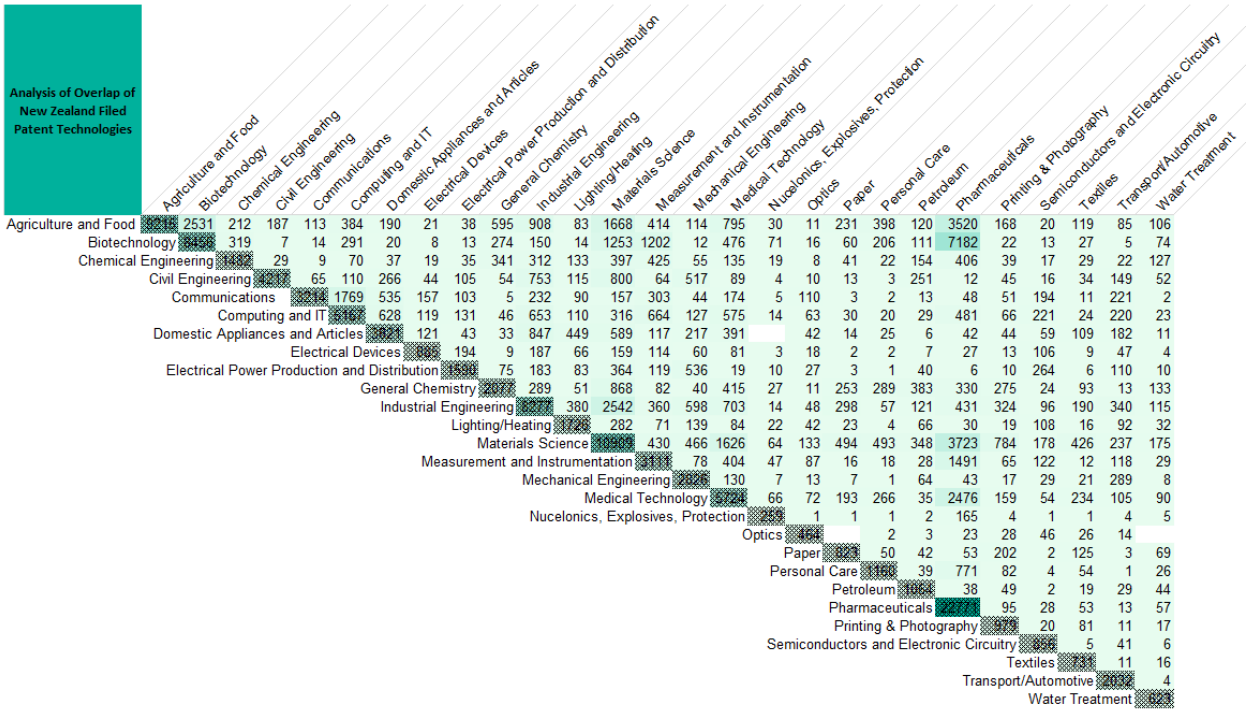
Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Agriculture and Food	9%	9%	8%	7%	8%	9%	8%	9%	10%	9%	9%	9%	10%	9%	8%	9%
Biotechnology	6%	7%	6%	5%	10%	10%	6%	7%	10%	8%	9%	10%	11%	12%	10%	10%
Chemical Engineering	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	2%	2%	2%	1%	1%	2%
Civil Engineering	4%	4%	5%	5%	4%	4%	4%	4%	3%	4%	4%	4%	3%	4%	4%	3%
Communications	4%	3%	3%	3%	4%	3%	3%	3%	3%	3%	3%	3%	2%	2%	3%	4%
Computing and IT	4%	5%	5%	6%	6%	4%	4%	4%	4%	6%	6%	5%	4%	5%	5%	5%
Domestic Appliances and Articles	5%	4%	5%	5%	4%	4%	3%	3%	2%	3%	3%	3%	3%	2%	3%	2%
Electrical Devices				1%	1%	1%										
Electrical Power Production and Distribution	1%	1%	1%	1%	1%	1%	2%	2%	1%	2%	2%	2%	2%	2%	1%	2%
General Chemistry	3%	3%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	1%	1%	1%	1%
Industrial Engineering	10%	10%	10%	11%	8%	8%	8%	7%	5%	7%	7%	6%	6%	6%	7%	5%
Lighting/Heating	2%	2%	2%	2%	2%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%	2%
Materials Science	9%	9%	9%	9%	9%	9%	11%	12%	11%	12%	11%	11%	12%	12%	12%	11%
Measurement and Instrumentation	3%	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	4%	3%	3%	3%	3%
Mechanical Engineering	3%	3%	3%	3%	3%	2%	3%	3%	2%	3%	3%	3%	2%	3%	2%	2%
Medical Technology	6%	6%	6%	6%	6%	6%	6%	5%	5%	5%	6%	5%	5%	6%	6%	6%
Nucelonics, Explosives, Protection																
Optics																
Paper	1%	1%	1%				1%									
Personal Care	1%	1%			1%	1%	1%	2%	1%	1%	1%	1%		1%	1%	1%
Petroleum	1%	1%	1%				1%	1%	1%	1%	1%	1%	1%		1%	
Pharmaceuticals	21%	22%	21%	19%	22%	24%	23%	23%	25%	20%	20%	21%	24%	24%	24%	23%
Printing & Photography	1%	1%	1%	1%			1%	1%				1%				
Semiconductors and Electronic Circuitry				1%			1%	1%	1%	1%	1%					
Textiles																
Transport/Automotive	2%	2%	2%	2%	2%	2%	2%	2%	1%	2%	2%	2%	2%	2%	2%	1%
Water Treatment																

While these tables confirm overall declines in publication beginning in 2013 (with a small increase in 2014), publications in 2019 show a slight increase, suggesting that a rebound may be in effect for New Zealand. This is particularly notable in Pharmaceuticals, Agriculture and Food, and Computing and IT.

CROSS DISCIPLINE NATURE OF NEW ZEALAND PATENT ACTIVITY

The patent categorization procedure used to define the technical fields of New Zealand activity was not limited to a single category per patent. As many categories are applied as necessary; for example, a novel semiconductor material would be included in both the **Materials Science** and **Semiconductors and Electronic Circuitry** fields.

The overlap between categories provides an opportunity to visualise the relationship between the disciplines and understand where overlap between fields is occurring.



Analysis of Overlap of New Zealand Filed Patent Technologies	Agriculture and Food	Biotechnology	Chemical Engineering	Civil Engineering	Communications	Computing and IT	Domestic Appliances and Articles	Electrical Devices	Electrical Power Production and Distribution	General Chemistry	Industrial Engineering	Lighting/Heating	Materials Science	Measurement and Instrumentation	Mechanical Engineering	Medical Technology	Nucelonics, Explosives, Protection	Optics	Paper	Personal Care	Petroleum	Pharmaceuticals	Printing & Photography	Semiconductors and Electronic Circuitry	Textiles	Transport/Automotive	Water Treatment
Agriculture and Food	2531	212	187	113	384	190	21	38	595	908	83	1668	414	114	795	30	11	231	398	120	3520	168	20	119	85	106
Biotechnology	8456	319	7	14	291	20	8	13	274	150	14	1253	1202	12	476	71	16	60	206	111	7182	22	13	27	5	74
Chemical Engineering	1432	29	9	70	37	19	35	341	312	133	397	425	55	135	19	8	41	22	154	406	39	17	29	22	127
Civil Engineering	2137	65	110	266	44	105	54	753	115	800	64	517	89	4	10	13	3	251	12	45	16	34	149	52
Communications	3214	1769	535	157	103	5	232	90	157	303	44	174	5	110	3	2	13	48	51	194	11	221	2
Computing and IT	4168	628	119	131	46	653	110	316	664	127	575	14	63	30	20	29	481	66	221	24	220	23
Domestic Appliances and Articles	2621	121	43	33	847	449	589	117	217	391		42	14	25	6	42	44	59	109	182	11
Electrical Devices	2888	194	9	187	66	159	114	60	81	3	18	2	2	7	27	13	106	9	47	4
Electrical Power Production and Distribution	1590	75	183	83	364	119	536	19	10	27	3	1	40	6	10	264	6	110	10
General Chemistry	2077	289	51	868	82	40	415	27	11	253	289	383	330	275	24	93	13	133
Industrial Engineering	3277	380	2542	360	598	703	14	48	298	57	121	431	324	96	190	340	115
Lighting/Heating	1726	282	71	139	84	22	42	23	4	66	30	19	108	16	92	32
Materials Science	10909	430	466	1626	64	133	494	493	348	3723	784	178	426	237	175
Measurement and Instrumentation	2111	78	404	47	87	16	18	28	1491	65	122	12	118	29
Mechanical Engineering	2026	130	7	13	7	1	64	43	17	29	21	289	8
Medical Technology	5724	66	72	193	266	35	2476	159	54	234	105	90
Nucelonics, Explosives, Protection	209	1	1	1	2	165	4	1	1	4	5
Optics	464		2	3	23	28	46	26	14	
Paper	923	50	42	53	202	2	125	3	69
Personal Care	1169	39	771	82	4	54	1	26
Petroleum	1064	38	49	2	19	29	44
Pharmaceuticals	22171	95	28	53	13	57
Printing & Photography	979	20	81	11	17
Semiconductors and Electronic Circuitry	656	5	41	6
Textiles	231	11	16
Transport/Automotive	2092	4
Water Treatment	623

The table above shows the number of inventions shared by each pair of technical categories.

The highest overlap occurs between the **Biotechnology**, **Pharmaceutical** and **Agriculture and Food** fields; indicating the closely related nature of IP in these technologies.

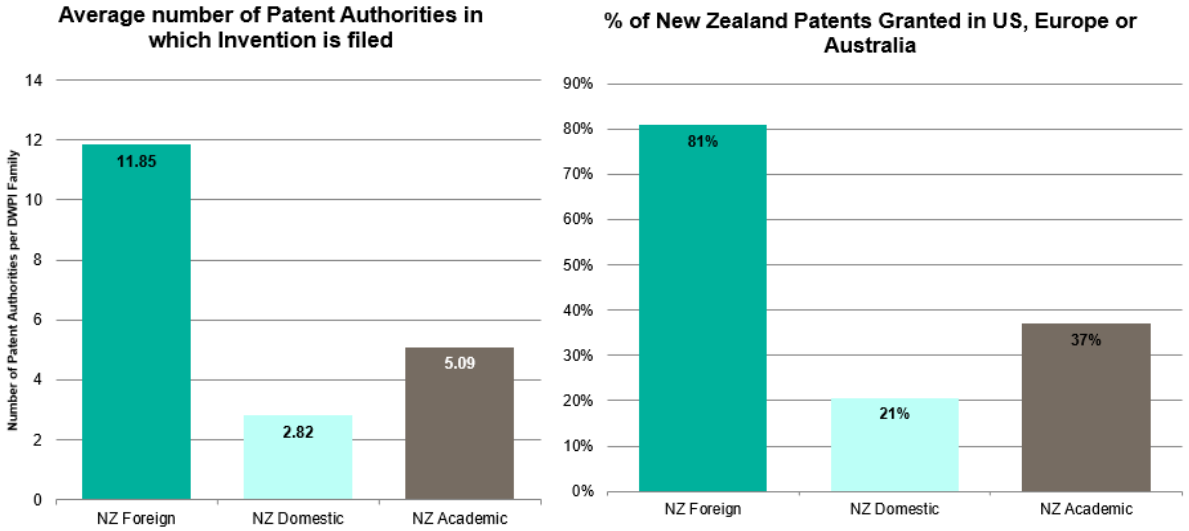
Other areas of cross-discipline innovation patented in New Zealand include:

- Pharmaceuticals and Materials Sciences
- Materials Sciences and Industrial Engineering
- Measurement and Instrumentation and Biotechnology

It should be noted that sectors in which no overlap are seen is likely due to incompatible or completely distinct technologies. For example, there is unlikely to be much correlation between Optics and Water Treatment.

NEW ZEALAND PATENT ACTIVITY – FILING INTENSITY AND FOREIGN GRANT SUCCESS

This analysis looks at two factors that measure the quality of the intellectual property being filed in New Zealand, broken down into inward (foreign) patent activity, all domestic New Zealand-based activity and activity attributable to New Zealand based academic institutions.



The two factors used relate to the patentability of the underlying inventions (grant success in the United States, Europe or Australia) and the confidence in return on investment (how widely filed the patent has been).

Patent filing breadth as a factor is intrinsic to the patent – it is a decision made by the applicant themselves, but include the assumption that applicant act rationally and only invest heavily in technologies they view as providing a high probability of success. A patent owner is unlikely to file an application in a jurisdiction they do not intend to commercialize.

Grant success is extrinsic to the patent – the decision to grant the patent rests finally with the patent examiner (in this case in Australia, at the European Patent Office or in the United States). Note that this success in this measurement is a grant achieved at any of these offices.

Inward patent applications (patents filed in New Zealand but first filed elsewhere) show very high levels of patent filing intensity and US-EP-AU grant success. The implications of these high levels are several:

- Foreign Applicants who choose to file in New Zealand do so as part of a strategy of achieving very wide global protection for the invention.
- These inventions should be viewed as 'strategic' in nature, and therefore would naturally have a greater prospect of grant success at the global patent authorities due to:
    - The much greater overall investment in an individual patent application in multiple authorities would commit the applicant to strong prosecution of the patent in each individual examining authority, e.g. through prompt and robust responses to office actions etc.

- The fact that these inventions have been chosen for global patent protection implies that they are inherently highly patentable, have had thorough review by patent attorneys and other professionals (e.g. corporate invention review committees), and have been judged to have a greater chance of success.

Domestic patent applications compare poorly to these global strategic patents. It was initially thought that this low level of grant success in foreign territories may be due to a low level of foreign filing, i.e. less opportunity for grant status to be achieved – only a small proportion of worldwide patents are applied for in 10+ patent authorities.

Broadly speaking the proportion of grant success in Australia, the United States, and the EPO align very closely to the values seen in the previous report, indicating that the downward trend is likely a component of the change in NZ patent law, and not a statement about the importance of New Zealand in the business strategies of entities.

% of New Zealand Domestic Patents filed in US, AU and EP; Grant Success of these in those territories

Foreign Filing Location of New Zealand Domestic Invention	Total Inventions	% of Domestic Activity Filed	Total Grants	% Grant Success in Location
Australia	2603	46%	1735	66.7%
United States	1962	32%	1431	72.9%
European Patent Office	1332	21%	1048	78.7%

However, the table shows the breakdown and % grant success of New Zealand domestic activity in each of the three sample patent jurisdictions.

In each, grant success rates are significantly below average grant success in those territories.

This evidence would appear to indicate that New Zealand domestic patent activity that is filed outside of New Zealand is of a lower patentability standard, or that patent examination is not being defended to the degree as it could be.

However, this view can be nuanced further by the inclusion of academic patent activity from New Zealand.

The filing intensity and foreign grant success of this tranche of inventions is notably higher than overall domestic rates, indicating that the academic sector in New Zealand is a particularly high-quality source of potentially commercializable technology.

PART 1A – ANALYSIS OF DOMESTIC NEW ZEALAND PATENT ACTIVITY

In this chapter of the study, attention focuses on the patent activity attributable to domestic New Zealand entities (those with a priority filing country of New Zealand).

MOST PROLIFIC PATENT FILING DOMESTIC ENTITIES

Top NZ Filing Domestic Entities
>10 Inventions

NZ Domestic Patent Assignee	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total Patent Families	% Recency (since 2014)
AgResearch	8	17	21	15	27	22	9	8	10	3	1	11	12	6	6	12	188	26%
University of Auckland	3	17	10	9	12	7	12	10	6	10	7	6	1	1		1	112	14%
Waikato University	4	5	6	2	9	6	4	4	4	5		5		2	1	3	60	18%
Fonterra Coop	2	6	8	5	7	11	6	3	4	3							55	0%
Gallagher Group	2	3	5	9	4	4	4	4	3	2	5	3	3	3			54	26%
Callaghan Innovation (Industrial Research)	9	8	5	6	5	5	4	3	3	3	1						52	2%
Massey University	4	4	3	3	3	5	4			3	6	1	3	3	3	5	50	42%
Horticulture & Food Research Inst	5	4	5	6	2	3	6	3	1	1							36	0%
Carter Hoyt Harvey	13	5	5	1	3	1	1	2	3								34	0%
Fisher & Paykel	2	4	7	8	5	4	1	1									32	0%
Assa Abloy NZ	7	3	2	3	5	3	1			2	2	1			2	1	32	19%
Corcel IP							4	1	7	3	10		4				29	48%
Bomac Research	2		1	2	2	5	12	2			2						28	7%
Bayer NZ					1	3	5	1	2	2	7	3	1	1			26	46%
Fletcher Building	2	3	1	4	3		2	1		1	2	1					20	15%
Tait Electronics	3	7	1	2	3		1			1							18	0%
Hubco Automotive						2	4	5	4	2							17	0%
WaikatoLink				1	4	5	2	1		3		1					17	6%
Zelam	1			1	2	3	1	3	2		1	1	1	1			17	24%
Warath					1					1	2	9	2				15	87%
NZ Dairy Board	4	3	2			1		1							2	2	15	27%
Sealed Air NZ		5	2		1	2	2		1	1							14	0%
Merial		2	2		1	1	2	4	2								14	0%
Livestock Improvement	1							1	2		2	1	3	2			12	67%
Tru-Test		1		1			1		2		1	4		1	1		12	58%

Foreign-owned companies

Above average recency

The table above shows all entities falling into the survey-defined “domestic NZ” category of New Zealand patent activity that have more than 10 patent families in the collection.

The table includes the timeline of these entities patent activity across the survey period, and also includes their total level of activity.

The most prolific entities include

- AgResearch
- University of Auckland
- Waikato University
- Fonterra Group; the dairy co-operative is a known exporter of diary technologies and this is confirmed by the activity seen in this study. Fonterra’s activity is consistent across all years.
- Gallagher Group
- Callaghan Innovation (Industrial Research Limited)
- Horticulture & Food Research Institute

The fact that several of the most prolific entities in this analysis form the academic sector in New Zealand confirms the strong nature of NZ Academic patent activity.

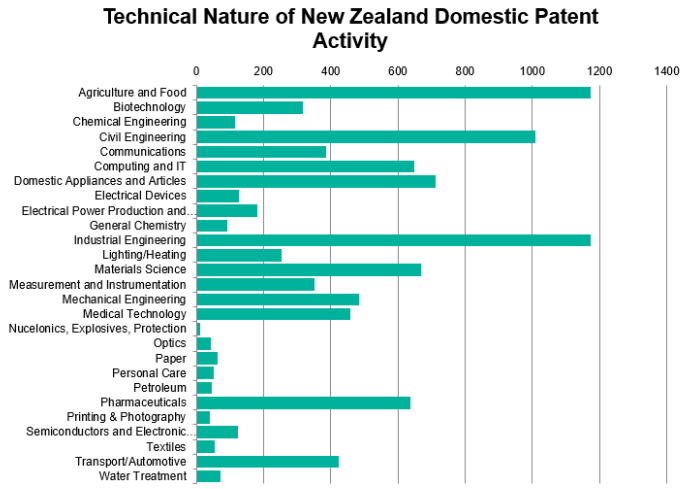
There are also several companies that are headquartered outside of New Zealand in the list – this implies that these entities are performing research and development in New Zealand.

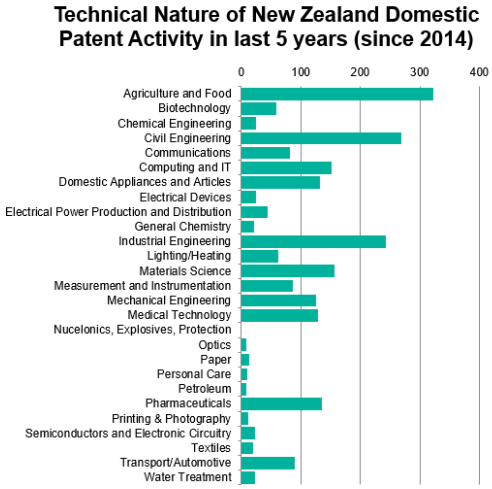
DOMESTIC NEW ZEALAND PATENT ACTIVITY BY TECHNOLOGY

The charts below show the patent activity filed in New Zealand by New Zealand-based entities broken down by technical field in the entire time frame studied (left) and in the last five years (right).

Whereas for foreign source New Zealand activity was heavily pharmaceutical and biotechnical in nature, in New Zealand industrial, agricultural and civil engineering disciplines dominate.

With high tech disciplines such as IT, telecommunications, semiconductors and biotechnology relatively low in the volume, this reveals that patented innovation from New Zealand is more primary industry focused.





TIMELINE OF TECHNOLOGIES PATENTED IN NEW ZEALAND BY DOMESTIC ENTITIES

This table repeats the earlier Part 1 analysis, however, only looks at patent activity by domestic entities. This is defined by the priority country of filing.

As the previous section highlighted the primary resource and primary industry focus of New Zealand innovation, this analysis provides a useful counterpoint: New Zealand may be by volume still primary industry focused, but this appears to be rapidly changing, with pharma/biotech and IT related innovation showing increased patent output.

The impact on publications in recent years make ascertaining overall trends challenging.

Technical Analysis of NZ Domestic Patent Activity

By volume

Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total	% Recency (since 2014)
Agriculture and Food	87	91	95	84	94	85	96	90	93	72	106	87	60	34	16	19	1209	27%
Biotechnology	26	30	24	15	47	24	27	29	22	21	17	10	14	10	4	4	324	18%
Chemical Engineering	10	14	4	11	16	6	9	8	7	7	8	5	8	1	2	1	117	21%
Civil Engineering	53	80	95	82	105	89	82	83	57	59	81	80	38	26	24	20	1054	26%
Communications	40	32	33	33	45	37	31	10	29	24	27	20	16	8	8	3	396	21%
Computing and IT	50	51	62	52	80	60	47	31	35	43	52	47	26	14	5	8	663	23%
Domestic Appliances and Articles	84	69	85	76	77	53	46	43	36	29	51	30	18	14	13	6	730	18%
Electrical Devices	8	13	10	9	17	15	9	10	10	7	11	4	3	2	1	4	133	19%
Electrical Power Production and Distribution	9	14	11	5	23	15	19	20	15	13	17	12	6	2	2	5	188	23%
General Chemistry	4	14	7	5	9	11	9	7	5	3	9	6	2	2	1	2	96	23%
Industrial Engineering	114	112	117	114	117	89	86	69	71	72	83	68	49	13	11	19	1204	20%
Lighting/Heating	23	21	29	26	26	18	17	14	14	10	28	16	8	4	3	4	261	24%
Materials Science	49	33	41	59	93	50	60	46	36	70	59	27	23	22	11	15	694	23%
Measurement and Instrumentation	22	30	30	43	43	18	19	24	26	20	28	20	15	15	5	4	362	24%
Mechanical Engineering	43	37	36	52	43	32	42	44	32	26	45	30	14	7	17	13	513	25%
Medical Technology	40	50	41	31	40	29	31	30	36	27	27	31	28	17	12	14	484	27%
Nucelonics, Explosives, Protection	3	1	2		3				1	2							12	0%
Optics	9	6	5	4	2	1	4		3	2	2	2	2		2		44	18%
Paper	4	7	3	2	13	1	5	6	4	6	4	3	4	2			64	20%
Personal Care	6	6	3	3	6	2	5	8	2	4	2	2	1	3	2		55	18%
Petroleum	3	3	3	4	5	5	7	3	3	3	2	3	3				47	17%
Pharmaceuticals	57	55	47	49	80	49	51	44	48	33	45	35	25	18	8	5	649	21%
Printing & Photography	3	3	2	7	3		3	4	1	3	3	4	2	2		1	41	29%
Semiconductors and Electronic Circuitry	12	9	11	11	14	9	11	10	9	9	15	4	1			3	128	18%
Textiles	5	2	2	2	4	4	9	3	7	3	5	5	5		2	3	61	33%
Transport/Automotive	33	41	38	47	37	26	37	32	27	31	23	24	18	11	9	5	439	21%
Water Treatment	7	7	7	7	2	8	8	2	4	5	6	4	4	2	4	4	81	30%

Above average recency

Technical Analysis of NZ Domestic Patent Activity

Normalized

Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Agriculture and Food	11%	11%	11%	10%	9%	12%	12%	13%	15%	12%	14%	15%	15%	15%	10%	12%
Civil Engineering	3%	4%	3%	2%	5%	3%	4%	4%	3%	3%	2%	2%	4%	4%	2%	2%
Computing and IT	1%	2%		1%	2%	1%	1%	1%	1%	1%	1%	1%	2%		1%	1%
Industrial Engineering	7%	10%	11%	10%	10%	12%	11%	12%	9%	10%	11%	14%	10%	11%	15%	12%
Materials Science	5%	4%	4%	4%	4%	5%	4%	1%	5%	4%	4%	3%	4%	3%	5%	2%
Water Treatment	6%	6%	7%	6%	8%	8%	6%	5%	6%	7%	7%	8%	7%	6%	3%	5%
Communications	10%	8%	10%	9%	7%	7%	6%	6%	6%	5%	7%	5%	5%	6%	8%	4%
Lighting/Heating	1%	2%	1%	1%	2%	2%	1%	1%	2%	1%	1%	1%	1%	1%	1%	2%
Domestic Appliances and Articles	1%	2%	1%	1%	2%	2%	2%	3%	2%	2%	2%	2%	2%	1%	1%	3%
Mechanical Engineering		2%	1%	1%	1%	1%	1%	1%	1%		1%	1%	1%	1%	1%	1%
Pharmaceuticals	14%	13%	14%	14%	11%	12%	11%	10%	11%	12%	11%	12%	12%	6%	7%	12%
Medical Technology	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	3%	2%	2%	2%	2%
Optics	6%	4%	5%	7%	9%	7%	8%	7%	6%	12%	8%	5%	6%	10%	7%	9%
Transport/Automotive	3%	4%	4%	5%	4%	2%	2%	4%	4%	3%	4%	3%	4%	7%	3%	2%
Biotechnology	5%	4%	4%	6%	4%	4%	5%	7%	5%	4%	6%	5%	4%	3%	10%	8%
Semiconductors and Electronic Circuitry	5%	6%	5%	4%	4%	4%	4%	4%	6%	4%	4%	5%	7%	7%	7%	9%
Electrical Power Production and Distribution																
Measurement and Instrumentation	1%	1%	1%				1%						1%		1%	
Textiles		1%			1%		1%	1%	1%	1%	1%	1%	1%	1%		
Printing & Photography	1%	1%			1%		1%	1%		1%				1%	1%	
General Chemistry						1%	1%					1%	1%			
Electrical Devices	7%	7%	6%	6%	8%	7%	7%	7%	8%	5%	6%	6%	6%	8%	5%	3%
Chemical Engineering				1%				1%				1%	1%	1%		1%
Personal Care	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%				2%
Nucelonics, Explosives, Protection	1%					1%	1%		1%		1%	1%	1%		1%	2%
Paper	4%	5%	5%	6%	4%	4%	5%	5%	4%	5%	3%	4%	5%	5%	6%	3%
Petroleum	1%	1%	1%	1%		1%	1%		1%	1%	1%	1%	1%	1%	2%	2%

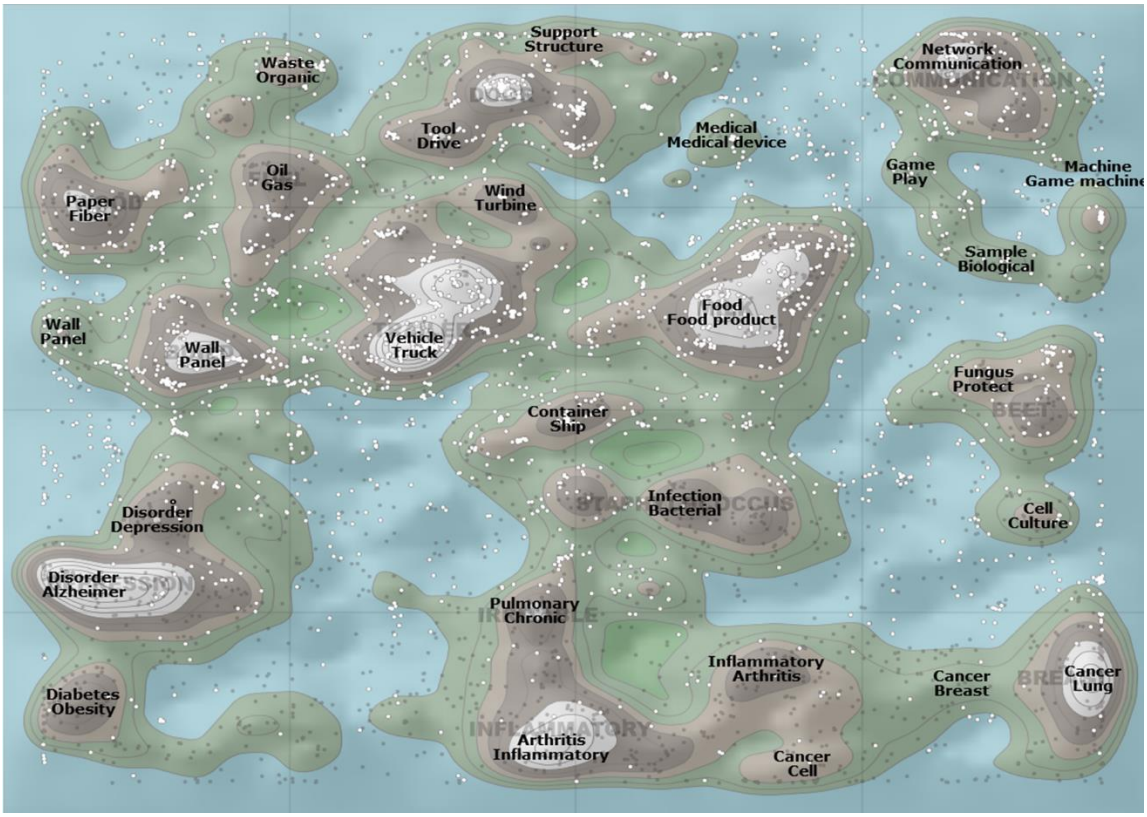
TECHNICAL LANDSCAPE OF NEW ZEALAND DOMESTIC PATENT ACTIVITY

The ThemeScape™ map shown below highlights patents that have come from domestic NZ entities.

The map shown below is of the complete New Zealand publication collection. Inventions highlighted in white display the locations of domestic New Zealand activity.

Within the pharma/biotech sector of the landscape, domestic New Zealand innovation clusters around cancer therapies and infectious disease therapeutics. Neurological conditions also appear to be a strength of New Zealand domestic innovation.

There is a strong presence in the food and agriculture sector, particularly around pest and parasite control. Construction and manufacturing also appear to be strong in New Zealand.



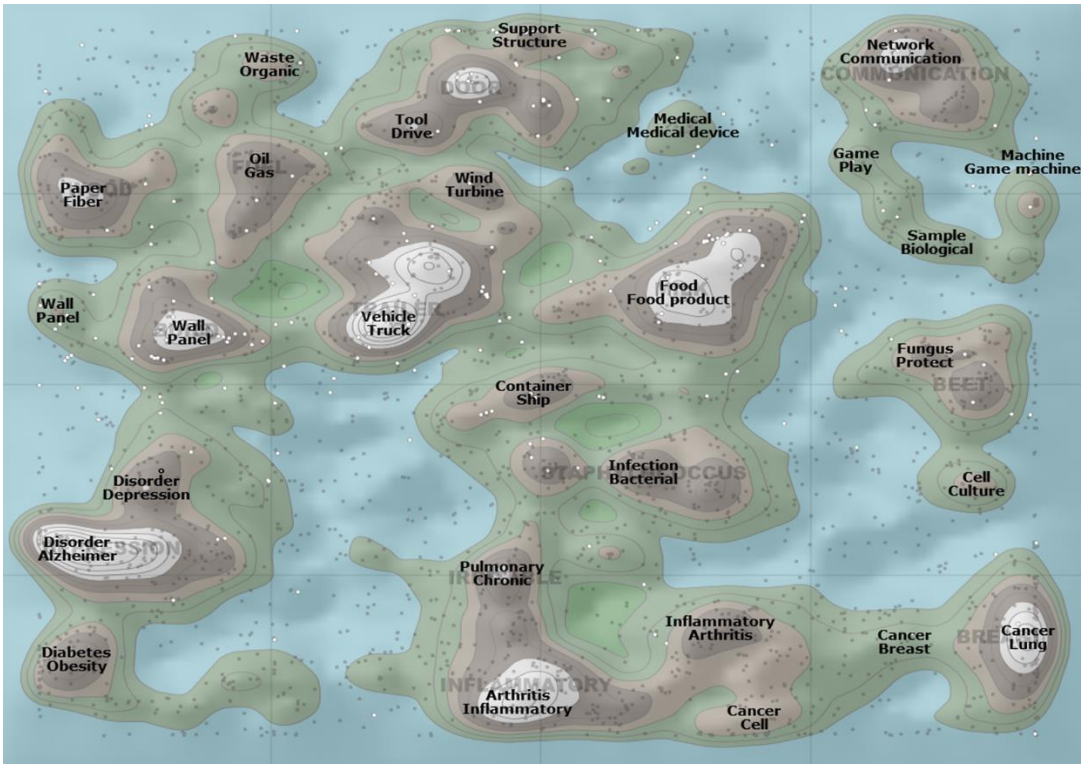
Another strong cluster within the power engineering sector is a cluster of activity regarding electrical power generation, particularly wind power generation.

In terms of civil engineering and industrial technology, there are strong clusters regarding building materials, tile manufacture and design and building cladding. There is also a strong element of paper processing and manufacture.

Finally, within the high-tech electronic sector, domestic New Zealand activity is fairly even across all sectors, indicating no specific strength.

A second version of the landscape is shown here and highlights “very recent” activity, i.e. documents filed since 2015 (white dots).

Here clusters of activity occur in pest control, cleantech and building materials.



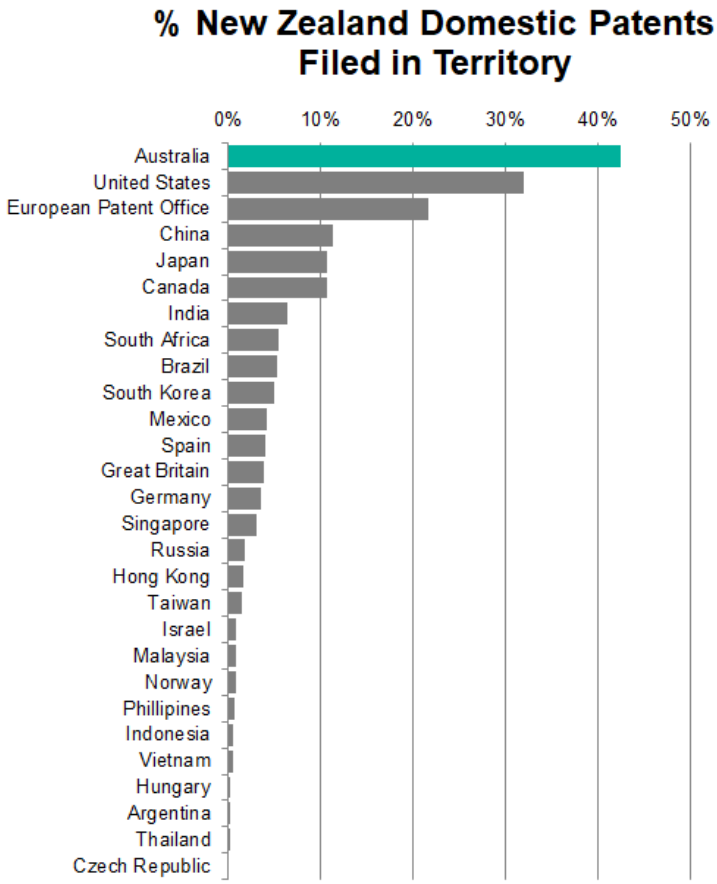
Mostly notable in this map seems to be a decline in the pharmaceutical and medical technology innovation. There are relatively few recent patents in areas previously seen, including neurobiology, oncology, and immune disorders like arthritis. This may be explained by the overall trends in activity seen across the board in New Zealand due to the changes in novelty requirements. Pharmaceutical patents tend to be very technically complex, and therefore determining absolute novelty takes more effort and time than in other technologies, increasing pendency.

FOREIGN FILING STRATEGY OF DOMESTIC NEW ZEALAND PATENTS

This section analyzes the domestic New Zealand patent families for follow-up filing locations outside of New Zealand.

The chart below measures the proportion of domestic New Zealand patents that are subsequently filed elsewhere, broken down by foreign location, in the entire time frame studied (left) and in the last five years (right).

Nearly half of all domestic NZ patents are also filed in Australia – highlighting the close trans-Tasman relationship between the two countries. Approximately one-third of New Zealand patents are also filed in the United States and nearly one quarter in Europe via the European Patent Office.



Outside of these territories, there is little further geographic concentration, although Chinese filings are up slightly from approximately 9% in the 2011 survey to nearly 12% in the current version. Japan is also up slightly, indicating a possible increase in Asia Pacific activity beyond the traditional Australian synergy.

ANALYSIS OF DOMESTIC NEW ZEALAND PATENT APPLICATIONS ALSO FILING IN AUSTRALIA

The table below summarizes the Australian patent activity of domestic New Zealand patent applicants. The table is sorted by the proportion of each entity's New Zealand activity also filed in Australia.

Assa Abloy, a Swedish-headquartered construction concern with a significant presence in New Zealand, leads the way with 80% of their New Zealand patents also filed in New Zealand. Fletcher Building, another construction company, is second, with 73% of patents filed in both jurisdictions. Both companies topped the same chart in the 2011 survey.

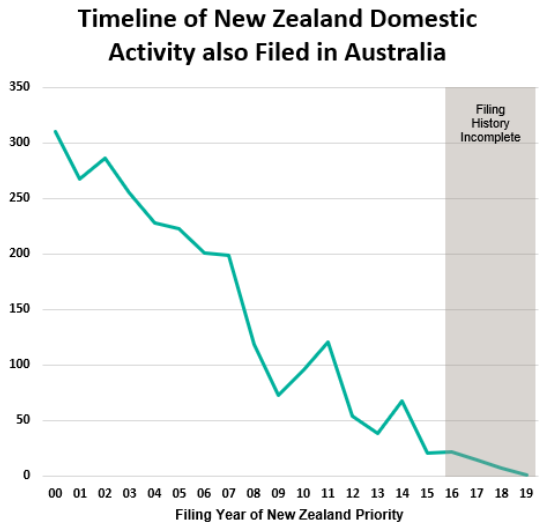
Top NZ Domestic Filing Entities also Filing in Australia

NZ Domestic Filing Entity	Total Patents also Filed in Australia	% of Activity also Filed in Australia
Assa Abloy NZ	16	80%
Fletcher Building	19	73%
Waikato University	37	73%
Fonterra Coop	39	70%
Fisher & Paykel	27	69%
Sealed Air NZ	10	67%
Industrial Research	38	60%
Horticulture & Food Research Inst	23	59%
WaikatoLink	10	59%
Bayer NZ	13	50%
Bomac Research	15	48%
AgResearch	97	48%
Hubco Automotive	8	47%
Tru-Test	7	44%
Massey University	27	42%
Zelam	7	41%
Gallagher Group	22	41%
Tait Electronics	11	39%
University of Auckland	42	37%
Corcel IP	8	28%
Livestock Improvement	4	25%
Carter Hoyt Harvey	10	23%
NZ Dairy Board	2	13%
Warath	2	13%

TIMELINE OF DOMESTIC NEW ZEALAND FILING ACTIVITY IN AUSTRALIA

This chart shows the number of domestic New Zealand patent applications also filed in Australia.

This chart emphasizes the declining trend of this type of patent application which had already been seen in the 2011 patent survey. It again suggests that the novelty requirements change is impacting activity in New Zealand.



PART 1B – ANALYSIS OF FOREIGN NEW ZEALAND PATENT ACTIVITY

This section of the report analyses the patent activity of entities based outside of New Zealand.

TOP FOREIGN ENTITIES FILING IN NEW ZEALAND

The table below shows the top 20 foreign New Zealand patent applicants, along with the industry in which their operate and the number of New Zealand-filed inventions.

The list is dominated by pharmaceutical companies – as expected due the very large number of pharmaceutical patents filed in New Zealand each year.

Top NZ Filing Foreign Entities

Foreign Entity Filing in New Zealand	Industry	Total Inventions Filed in New Zealand
Novartis	Pharma	752
Janssen	Pharma	527
AstraZeneca	Pharma	525
Sanofi	Pharma	523
Boehringer Ingelheim	Pharma	484
Pfizer	Pharma	440
Hoffman La Roche	Pharma	421
Bayer	Pharma	405
Illinois Tool Works	Industrial	356
BASF	Chemical	339
Genentech	Pharma	276
Bristol-Myers Squibb	Pharma	270
Dow	Chemical	268
Abbott	Pharma	243
Schering	Pharma	240
Les Lab Servier	Pharma	238
Qualcomm	Telecom	232
Vertex	Pharma	218
Wyeth	Pharma	214
Gilead	Pharma	213

Non-pharmaceutical foreign New Zealand patent applicants include chemical companies BASF and Dow, Telecoms and Telecom giant Qualcomm and tooling manufacture ITW, also known as Illinois Tool Works.

BASF's New Zealand portfolio centres around agricultural pest control, particularly fungicides, indicating that New Zealand is a strong market for BASF.

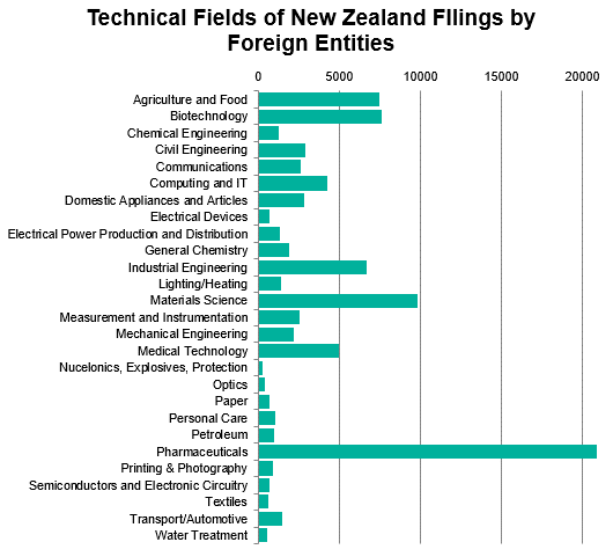
Qualcomm's activity relates to cellular telephone equipment.

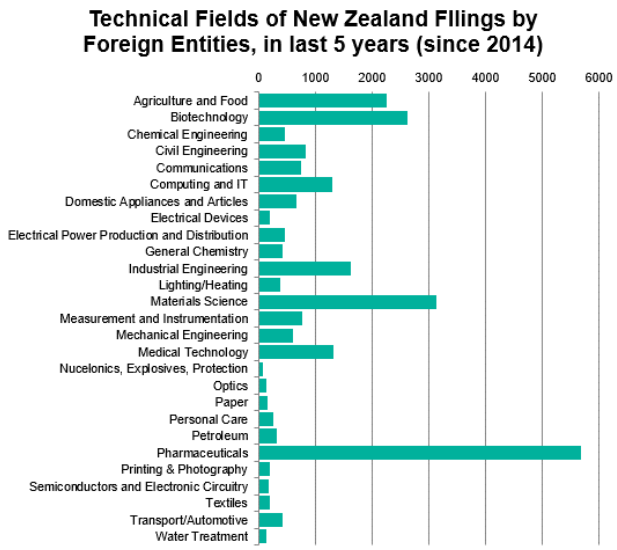
ITW's portfolio relates to handheld tools, adhesives, packaging and assorted other items, indicating that New Zealand patent protection may important for patents of a global market nature.

TECHNICAL ANALYSIS OF FOREIGN PATENT APPLICATIONS

The chart below shows the technical fields associated with foreign patent applications into New Zealand.

As previously identified, these applications are dominated by global, strategic pharmaceutical patents.





This table shows the technical nature of the foreign applications broken down over time, with a recency calculated for the most recent 5 years of activity.

The categories showing growth include Paper, Optics, and Communications. Please note that due to the recent decline in activity due to changes in New Zealand patent law, it is premature to draw many conclusions from these figures. For example, Computing and IT show an increase in activity in 2019, but this is not significant enough to suggest a recent consistent upward trend. The trend that most technical entities are considered to be "stagnant" is more likely a reflection of the backlog in examinations, rather than a wholesale decline in interest in New Zealand as a commercial target.

Technical Trends for NZ Filing Foreign Entities

Excludes Incomplete Years

Technical Categories	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total	% Recency (since 2014)
Agriculture and Food	395	428	393	311	395	463	519	677	906	583	560	512	435	270	229	262	7338	31%
Biotechnology	295	360	345	240	503	565	427	565	1,045	582	653	621	515	331	237	263	7547	35%
Chemical Engineering	57	53	77	54	47	76	94	131	133	109	131	112	98	31	33	55	1291	36%
Civil Engineering	166	183	209	191	154	170	232	241	233	210	213	191	138	103	99	95	2828	30%
Communications	155	171	151	151	178	126	213	202	239	215	215	161	95	68	85	126	2551	29%
Computing and IT	175	239	257	265	283	199	295	330	415	384	365	280	193	141	150	175	4146	31%
Domestic Appliances and Articles	211	201	229	212	175	179	212	228	216	168	199	147	115	67	72	76	2707	25%
Electrical Devices	35	32	33	50	48	58	54	61	76	53	49	51	24	24	21	22	691	28%
Electrical Power Production and Distribution	54	61	74	65	51	67	104	113	135	132	111	113	91	61	30	55	1317	35%
General Chemistry	140	140	127	84	90	108	177	192	258	130	134	104	72	29	38	45	1868	23%
Industrial Engineering	453	535	523	478	362	428	541	523	496	407	441	344	264	199	201	175	6370	25%
Lighting/Heating	90	87	101	77	73	76	81	113	109	110	123	83	51	43	38	51	1306	30%
Materials Science	429	506	503	435	409	508	820	993	1,154	757	820	707	555	381	333	338	9648	32%
Measurement and Instrumentation	119	115	149	128	147	182	194	239	296	182	206	210	131	72	66	81	2517	30%
Mechanical Engineering	129	144	149	141	112	109	157	185	179	166	154	135	102	82	59	68	2071	29%
Medical Technology	281	301	319	281	311	347	467	390	507	323	389	280	198	147	150	162	4853	27%
Nucelonics, Explosives, Protection	15	15	20	14	9	12	17	19	29	16	32	14	7	5	5	7	236	30%
Optics	22	25	13	24	13	23	30	30	31	28	26	25	23	16	18	27	374	36%
Paper	49	68	59	36	32	29	76	65	72	50	58	44	18	13	14	20	703	24%
Personal Care	62	52	52	41	50	59	84	132	155	91	79	61	42	27	16	30	1033	25%
Petroleum	47	65	59	39	35	45	67	87	139	65	96	84	58	27	28	31	972	33%
Pharmaceuticals	1,154	1,275	1,241	980	1,209	1,427	1,721	1,977	2,611	1,425	1,498	1,350	1,095	651	535	549	20698	27%
Printing & Photography	65	72	65	49	41	38	112	83	93	45	45	56	33	25	24	26	872	24%
Semiconductors and Electronic Circuitry	14	35	36	37	37	33	55	66	86	75	60	35	26	28	14	25	662	28%
Textiles	30	40	51	30	19	32	37	60	65	55	55	44	30	24	20	23	615	32%
Transport/Automotive	88	94	98	85	71	88	124	128	122	83	125	80	67	54	57	42	1406	30%
Water Treatment	24	32	30	27	21	31	36	64	55	42	56	25	17	21	11	15	507	29%

Above average recency

Technical Trends for NZ Filing Foreign Entities (normalized)

Excludes Incomplete Years

Technical Categories	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Agriculture and Food	8%	8%	7%	7%	8%	8%	7%	9%	9%	9%	8%	9%	10%	9%	9%	9%
Biotechnology	6%	7%	6%	5%	10%	10%	6%	7%	11%	9%	9%	11%	11%	11%	9%	9%
Chemical Engineering	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	2%	2%	2%	1%	1%	2%
Civil Engineering	3%	3%	4%	4%	3%	3%	3%	3%	2%	3%	3%	3%	3%	4%	4%	3%
Communications	3%	3%	3%	3%	4%	2%	3%	3%	2%	3%	3%	3%	2%	2%	3%	4%
Computing and IT	4%	4%	5%	6%	6%	4%	4%	4%	4%	6%	5%	5%	4%	5%	6%	6%
Domestic Appliances and Articles	4%	4%	4%	5%	4%	3%	3%	3%	2%	3%	3%	3%	3%	2%	3%	3%
Electrical Devices	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Electrical Power Production and Distribution	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	1%	2%
General Chemistry	3%	3%	2%	2%	2%	2%	3%	2%	3%	2%	2%	2%	2%	1%	1%	2%
Industrial Engineering	10%	10%	10%	11%	7%	8%	8%	7%	5%	6%	6%	6%	6%	7%	8%	6%
Lighting/Heating	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%	2%	1%	1%	1%	1%	2%
Materials Science	9%	9%	9%	10%	8%	9%	12%	13%	12%	12%	12%	12%	12%	13%	13%	12%
Measurement and Instrumentation	3%	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	4%	3%	2%	3%	3%
Mechanical Engineering	3%	3%	3%	3%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%	2%
Medical Technology	6%	6%	6%	6%	6%	6%	7%	5%	5%	5%	6%	5%	4%	5%	6%	6%
Nucelonics, Explosives, Protection																
Optics				1%									1%	1%	1%	1%
Paper	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%			1%	1%
Personal Care	1%	1%	1%	1%	1%	1%	1%	2%	2%	1%	1%	1%	1%	1%	1%	1%
Petroleum	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Pharmaceuticals	24%	24%	23%	22%	25%	26%	25%	25%	26%	22%	22%	23%	24%	22%	21%	19%
Printing & Photography	1%	1%	1%	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Semiconductors and Electronic Circuitry		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Textiles	1%	1%	1%	1%		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Transport/Automotive	2%	2%	2%	2%	1%	2%	2%	2%	1%	1%	2%	1%	1%	2%	2%	1%
Water Treatment	1%	1%	1%	1%		1%	1%	1%	1%	1%	1%			1%		1%

GEOGRAPHIC SOURCE OF FOREIGN NEW ZEALAND PATENT FILINGS

This section analyzes the location of the inward patent applications to the New Zealand patent office.

The analysis utilizes the same methodology as previously used to define NZ and non-NZ intellectual property – the location of the priority (or first) patent application.

The table shows both the total number of New Zealand patent applications per foreign priority country, as well as the trend over time with a linear regression[9] calculated for the most recent 4 years of activity, and again annotated with the mode of activity.

The highest numbers of foreign applications come from the United States, Australia, the EPO and the United Kingdom – revealing cultural, historical and economic links.

[9] Inventions per year

Geographic Source of NZ Foreign Filings

Locations with >50 NZ Patent Families

Priority Filing Country	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total	Inventions per year (Linear Regression)	Activity Mode
Brazil	1	6	2	3	4	1	5	4	6	4	3	3	2	4	2	4	50	50%	Growing
Norway	16	12	14	9	11	11	12	14	21	28	9	3	4	1	9	6	174	21%	Growing
Taiwan	6	4	3	1	3	4	10	3	7	5	5	5	7	6	5	8	82	20%	Growing
Belgium	2	2		7	1	5	6	8	8	10	5	5	5	10	2	11	76	9%	Growing
South Korea	26	9	16	12	13	21	27	31	31	19	34	20	25	12	12	34	308	4%	Growing
China	9	5	5	3	5	3	19	22	23	36	35	57	57	44	49	57	372	2%	Growing
Japan	105	152	101	81	79	108	192	191	218	170	128	107	99	60	68	95	1859	0%	Stagnant
United States	1,023	1,106	1,201	1,055	1,192	1,290	1,660	1,884	2,468	1,563	1,737	1,480	1,170	850	745	717	20424	-1%	Stagnant
Great Britain	306	271	254	208	190	253	309	339	332	237	233	183	127	60	59	70	3361	-3%	Stagnant
Australia	299	292	282	339	347	328	375	425	407	323	366	263	178	128	95	104	4447	-3%	Stagnant
Germany	130	216	195	148	107	194	220	170	156	114	90	93	87	43	17	32	1980	-4%	Stagnant
India	10	9	7	10	18	16	30	52	88	47	38	58	44	20	14	12	461	-8%	Stagnant
France	81	122	86	67	63	65	123	113	144	97	82	69	38	30	19	21	1199	-13%	Declining
Sweden	78	76	72	39	42	38	65	55	66	40	47	22	17	21	10	11	688	-18%	Declining
Austria	16	9	7	9	12	10	14	21	16	8	9	8	9	6	6	8	160	-22%	Declining
Russia		1	7		3	3	4	5	6	2	4	11	5	0	3	2	54	-23%	Declining
Italy	29	36	29	26	19	28	40	44	40	50	37	29	20	23	17	13	467	-25%	Declining
South Africa	10	7	8	3	10	13	11	13	21	4	7	15	9	4	7	5	142	-31%	Declining
Netherlands	22	17	28	18	12	5	20	23	23	22	18	14	9	10	5	7	246	-37%	Declining
Canada	17	19	21	19	8	4	7	10	5	6	5	4	5	5	1	1	136	-50%	Declining
Denmark	29	39	41	21	35	43	56	52	51	35	20	23	8	7	6	4	466	-74%	Declining
Finland	12	26	16	13	12	6	12	16	12	6	7	14	6	6	4	3	168	-81%	Declining
Ireland	5	6	8	6	3	4	5	10	13	10	7	8	2	3	1	1	91	-91%	Declining
Spain	11	17	17	6	18	10	27	19	13	14	9	4	4	3	2	1	174	-100%	Declining
Hungary	3	9	3	3	2	6	4	7	9	7	4	5	2	1	0	1	65	-100%	Declining
Israel	15	15	9	12	6	12	11	7	5	3	2	2	3	2	2	1	106	-150%	Declining
Switzerland	8	19	17	7	6	14	6	9	8	7	5	10	3	3	2	2	124	-200%	Declining

Growing countries include Brazil, Norway, Taiwan, Belgium, South Korea and China. China and South Korea are amongst the larger entities filing in New Zealand, indicating a new interest in protection in New Zealand.

Geographic Source of NZ Foreign Filings (normalized)

Locations with >50 NZ Patent Families

Priority Filing Country	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Brazil																
Norway	1%		1%						1%	1%					1%	
Taiwan																1%
Belgium														1%		1%
South Korea	1%		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%
China							1%	1%	1%	1%	1%	2%	3%	3%	4%	5%
Japan	5%	6%	4%	4%	4%	4%	6%	5%	5%	6%	4%	4%	5%	4%	6%	8%
United States	45%	44%	49%	50%	54%	52%	51%	53%	59%	55%	59%	59%	60%	62%	64%	58%
Great Britain	13%	11%	10%	10%	9%	10%	9%	10%	8%	8%	8%	7%	7%	4%	5%	6%
Australia	13%	12%	12%	16%	16%	13%	11%	12%	10%	11%	12%	10%	9%	9%	8%	8%
Germany	6%	9%	8%	7%	5%	8%	7%	5%	4%	4%	3%	4%	4%	3%	1%	3%
India					1%	1%	1%	1%	2%	2%	1%	2%	2%	1%	1%	1%
France	4%	5%	4%	3%	3%	3%	4%	3%	3%	3%	3%	3%	2%	2%	2%	2%
Sweden	3%	3%	3%	2%	2%	2%	2%	2%	2%	1%	2%	1%	1%	2%	1%	1%
Austria	1%				1%			1%							1%	1%
Russia																
Italy	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	1%	1%	2%	1%	1%
South Africa						1%			1%			1%			1%	
Netherlands	1%	1%	1%	1%	1%		1%	1%	1%	1%	1%	1%		1%		1%
Canada	1%	1%	1%	1%												
Denmark	1%	2%	2%	1%	2%	2%	2%	1%	1%	1%	1%	1%		1%	1%	
Finland	1%	1%	1%	1%	1%							1%				
Ireland																
Spain		1%	1%		1%		1%	1%								
Hungary																
Israel	1%	1%		1%												
Switzerland		1%	1%			1%										

GEOGRAPHIC FILING PATTERN OF FOREIGN NEW ZEALAND APPLICATIONS

This table looks at the co-filed patent authorities (in addition to New Zealand) of patents filed by foreign applicants. Note that the table does not include PCT publications.

Pattern of International Patent Filing that includes New Zealand

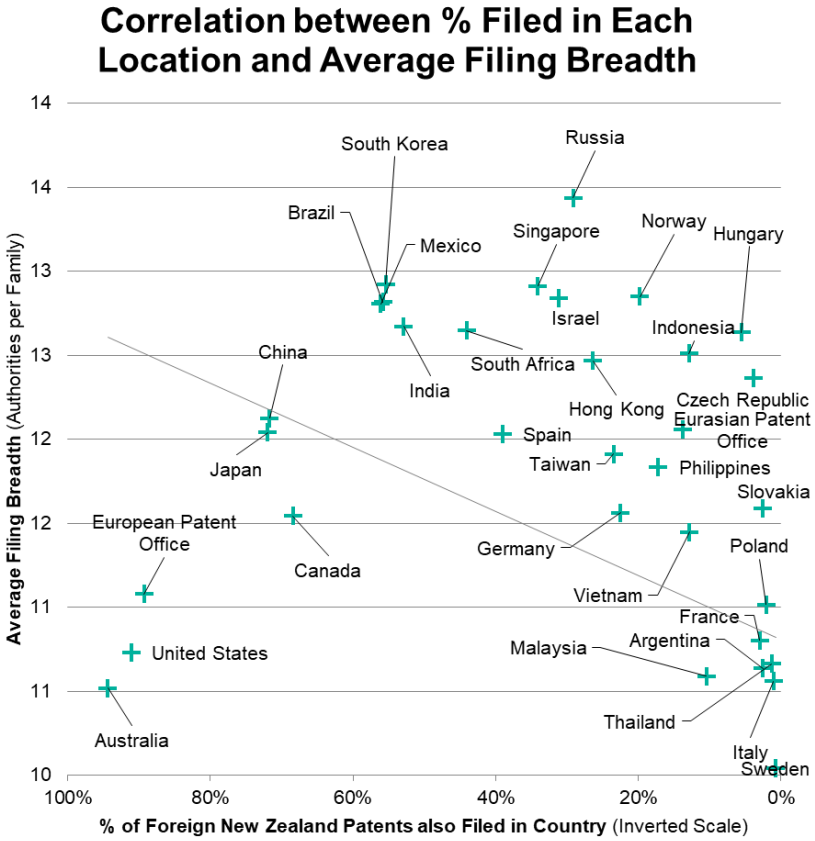
>100 filings

Country	Number of NZ Foreign Filings also in Location	% of NZ Foreign Filings also Filed in Location	Average Filing Breadth
Australia	43761	94%	10.52
United States	42222	91%	10.73
European Patent Office	41420	89%	11.08
Japan	33370	72%	12.04
China	33274	72%	12.12
Canada	31745	68%	11.54
Mexico	26024	56%	12.80
Brazil	25894	56%	12.82
South Korea	25687	55%	12.92
India	24535	53%	12.67
South Africa	20445	44%	12.65
Spain	18126	39%	12.03
Singapore	15814	34%	12.91
Israel	14428	31%	12.84
Russia	13502	29%	13.44
Hong Kong	12220	26%	12.47
Taiwan	10889	23%	11.91
Germany	10446	23%	11.56
Norway	9182	20%	12.85
Philippines	8028	17%	11.83
Eurasian Patent Office	6360	14%	12.06
Indonesia	5983	13%	12.51
Vietnam	5952	13%	11.45
Malaysia	4858	10%	10.59
Hungary	2581	6%	12.64
United Kingdom	1995	4%	9.11
Czech Republic	1799	4%	12.36
France	1374	3%	10.80
Gulf States	1202	3%	6.46
Argentina	1179	3%	10.64
Georgia	1161	3%	8.12
Slovakia	1161	3%	11.59
Poland	966	2%	11.02
Thailand	619	1%	10.66
Ukbekistan	605	1%	6.02
Italy	496	1%	10.56
Sweden	351	1%	10.04
Luxembourg	339	1%	9.17
Belarus	287	1%	10.68
Thailand	211	0%	9.39
Poland	185	0%	9.79
Kazakhstan	174	0%	9.82
Moldova	143	0%	6.58
Belgium	131	0%	10.81
Denmark	129	0%	9.53

The table is sorted by the proportion of activity co-filed in each territory. The table also includes a count of the average number of authorities in total are included on patent applications including the co-filing nation.

The analysis shows that ***almost all patents filed in New Zealand by foreign applicants are also filed in Australia***, and the vast majority are also filed in the US, at the EPO and in Japan.

Two-thirds of patents filed in New Zealand have also been filed in China. This co-filing between New Zealand and China has increased from 65% to 72% since the previous report. This high level of global patent protection once more emphasizes the high value nature of patents which foreign applicants choose to file in New Zealand.



PART 2 – ANALYSIS OF NEW ZEALAND ACADEMIC PATENT ACTIVITY

ACADEMIC PATENT ACTIVITY IN NEW ZEALAND

Part 2 of the New Zealand Patent Survey moves away from the national characteristics of patent activity, and instead focuses on the activity of New Zealand academic institutions.

The following entities are included in the analysis of academic activity:

Universities:

- University of Auckland
- Auckland University of Technology
- Lincoln University
- Massey University
- University of Otago
- University of Waikato
- Victoria University of Wellington
- University of Canterbury
- Waikato Institute of Technology

Crown Research Institutes:

- AgResearch
- GNS Science
- Industrial Research Limited
- Institute for Environmental Science & Research
- Landcare Research
- National Institute of Water and Atmospheric Research
- New Zealand Institute for Plant & Food Research
- Scion (New Zealand Forest Research Institute)

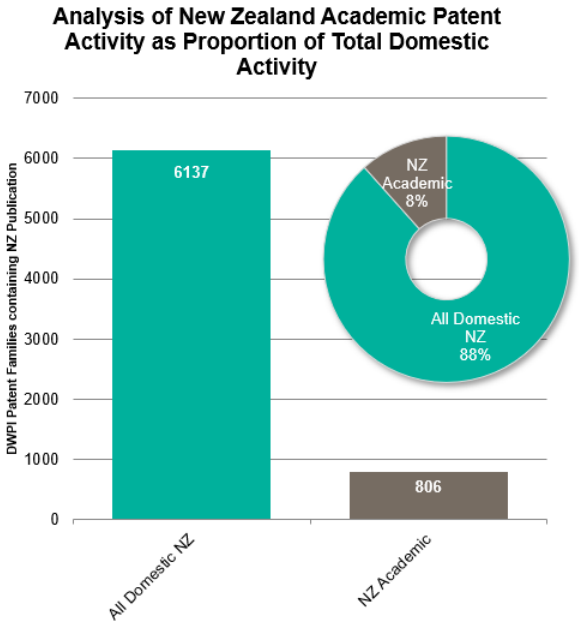
It should be noted that the Auckland University of Technology, Waikato Institute of Technology and Lincoln University were not found listed as the assignee on any New Zealand publication in the Derwent World Patents Index™, and therefore are not covered by the patent survey.

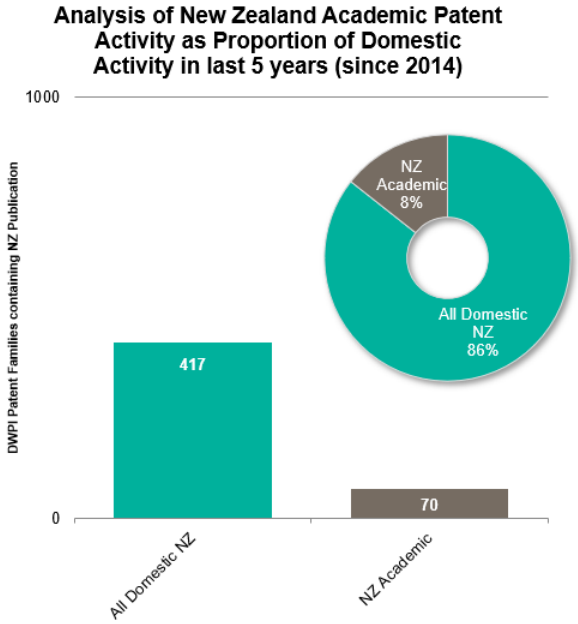
These entities' New Zealand patent portfolios were collated by associating with them patents directly assigned to the universities or research institutes, or to corporate entities with which the institution has been associated, e.g. Technology Transfer legal entities, or spin-off corporations.

Examples include Canterprise Ltd – the technology transfer enterprise for the University of Canterbury, or CoDa Therapeutics – a company associated with the University of Auckland.

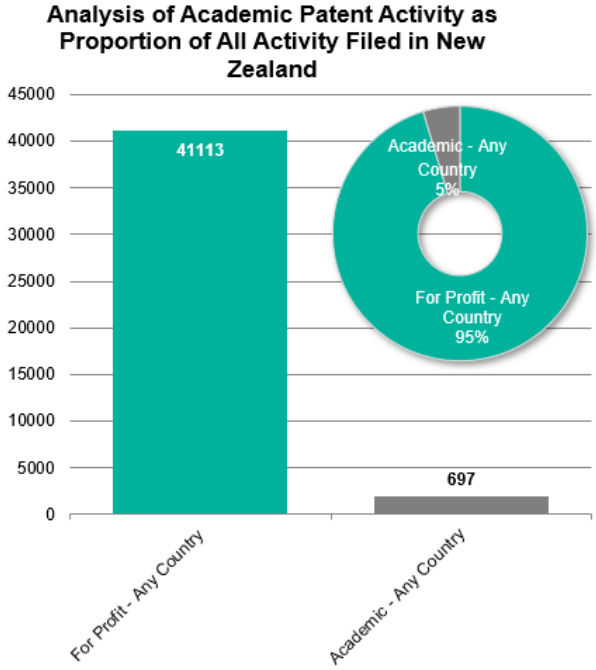
TECHNICAL ANALYSIS OF NEW ZEALAND PATENT ACTIVITY

The charts below represent the level of patent activity within New Zealand as a function of all domestic activity, for the entire time frame studied and in the last 5 years; and following analyses the level of academic IP represented in the foreign New Zealand-filed collection.





Overall, 8% of patent activity in New Zealand comes from one of the 15 universities or CRIs included in the study.



This compares to 5% for the foreign collection;

This would either imply that New Zealand has a higher than average level of academic IP output or that less worldwide academic IP is filed in New Zealand.

It is suspected that the latter is more likely, meaning that this lower figure may be artificially low, as it has already been established that patents filed in New Zealand are generally of high value or of strategic worth to the applicant – something that may be difficult for an academic patent applicant to determine during initial patent prosecution.

However, it is also possible that New Zealand has a higher than average academic sector. A true picture may only be possible if a direct nation-to-nation comparison is made.

TECHNICAL TRENDS IN NEW ZEALAND ACADEMIC PATENT ACTIVITY

The chart below shows the breakdown of all academic patent activity in New Zealand by the technical categories previously introduced.

Topics highlighted in teal are fields in which the academic sector is relatively over-represented, and those in grey are lower in activity.

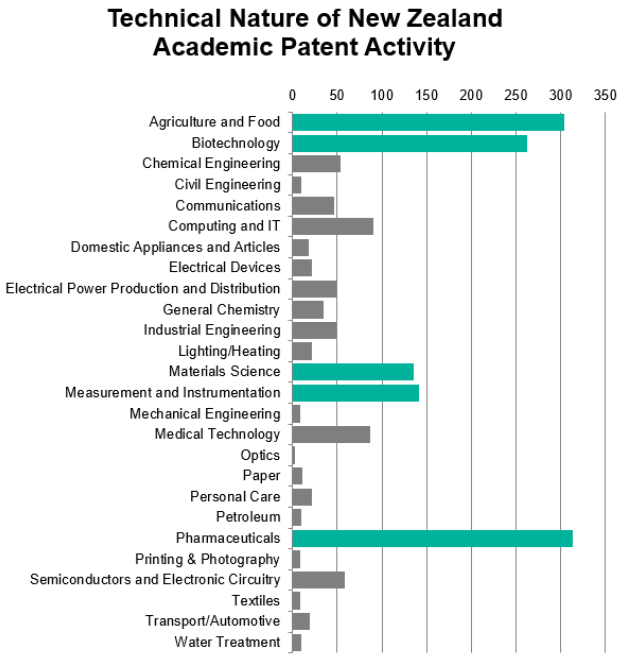
Disciplines of high activity include:

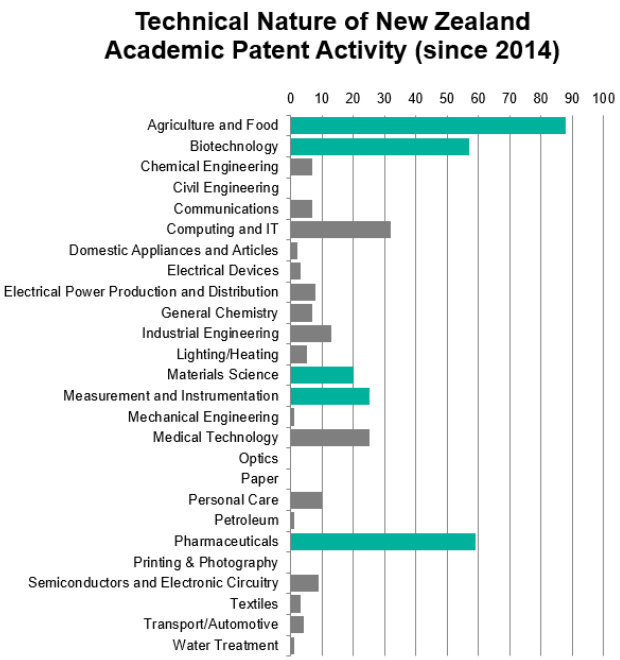
- Pharmaceuticals
- Agriculture and Food
- Biotechnology
- Measurement and Instrumentation
- Materials Sciences

These disciplines are those where traditionally academic IP commercialization takes place, except for semiconductors.

Also, New Zealand has strong domestic corporate activity in both Materials Science and Agriculture and Food.

This being the case, further analysis is required to differentiate between high absolute levels of academic patent activity and high relative levels of academic activity across New Zealand domestic patent output as a whole.





Technical Nature of all New Zealand Patent Activity, By Source, since 2000

Annotated with above average representation by NZ Academic

Technical Category	Domestic	NZ Academic	% NZ Academic	
Biotechnology	345	262	76%	Academic Centric Research Fields
Pharmaceuticals	697	313	45%	
Chemical Engineering	123	53	43%	
Semiconductors and Electronic Circuitry	137	58	42%	
Personal Care	57	21	37%	
Measurement and Instrumentation	394	141	36%	
General Chemistry	106	35	33%	
Electrical Power Production and Distribution	206	49	24%	Industrial/Commercial Research Fields
Agriculture and Food	1375	304	22%	
Petroleum	50	10	20%	
Materials Science	743	135	18%	
Printing & Photography	48	8	17%	
Medical Technology	541	87	16%	
Paper	72	11	15%	
Electrical Devices	149	22	15%	
Computing and IT	736	90	12%	
Textiles	66	8	12%	
Water Treatment	90	10	11%	
Communications	456	47	10%	
Lighting/Heating	294	21	7%	
Optics	55	3	5%	
Transport/Automotive	492	19	4%	
Industrial Engineering	1394	49	4%	
Domestic Appliances and Articles	870	18	2%	
Mechanical Engineering	573	8	1%	
Civil Engineering	1170	10	1%	
Nucelonics, Explosives, Protection	12	0	0%	

Technical Nature of all New Zealand Patent Activity, By Source, since 2014
Annotated with above average representation by NZ Academic

Technical Category	Domestic	NZ Academic	% NZ Academic
Personal Care	10	10	100%
Biotechnology	59	57	97%
Pharmaceuticals	136	59	43%
Semiconductors and Electronic Circuitry	23	9	39%
General Chemistry	22	7	32%
Measurement and Instrumentation	87	25	29%
Chemical Engineering	25	7	28%
Agriculture and Food	322	88	27%
Computing and IT	152	32	21%
Medical Technology	129	25	19%
Electrical Power Production and Distribution	44	8	18%
Textiles	20	3	15%
Materials Science	157	20	13%
Petroleum	8	1	13%
Electrical Devices	25	3	12%
Communications	82	7	9%
Lighting/Heating	63	5	8%
Industrial Engineering	243	13	5%
Transport/Automotive	90	4	4%
Water Treatment	24	1	4%
Domestic Appliances and Articles	132	2	2%
Mechanical Engineering	126	1	1%
Civil Engineering	269	0	0%
Optics	8	0	0%
Paper	13	0	0%
Printing & Photography	12	0	0%
Nucelonics, Explosives, Protection	0	0	-

Academic Centric Research Fields

Industrial/Commercial Research Fields

The tables above show the proportion of overall domestic New Zealand patent activity and domestic New Zealand patent activity in the last 5 years, that is represented by the academic community.

Highlighted are sectors where academic IP output is greater than 25% of the national total output. This shows that there are seven fields in which the New Zealand academic community presents a significant minority of all patent output:

- Biotechnology (in this case, academic patent output represents 76% of national activity)
- Pharmaceuticals
- Chemical Engineering
- Semiconductors and Electronic Circuitry
- Personal Care
- Chemical Engineering
- Measurement and Instrumentation
- General Chemistry

The table analyses the timeline of activity and percentage recency (percentage inventions filed in the last 5 years) in each of the technical fields.

Technical Field Drift of New Zealand Academic Patent Research

Excludes Incomplete Years

Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total All Years	% Recency (since 2014)
Agriculture and Food	12	25	22	19	34	43	34	12	7	10	5	16	12	8	15	32	306	29%
Biotechnology	14	23	20	19	42	42	34	16	9	11	6	4	5	5	12	25	287	20%
Chemical Engineering		9	5	7	10	7	6	3	2	3					1	6	59	12%
Civil Engineering			3	1	3			2	1								10	0%
Communications	1	5	4	1	9	7	6	4	3	1		3	2			2	48	15%
Computing and IT	2	8	6	3	12	13	10	3	4	1	1	5	7	7	2	10	94	34%
Domestic Appliances and Articles	4	5	2	1		3	2	2				1		1			21	10%
Electrical Devices	2			1	3	1	2	1	4	4	2				1		21	14%
Electrical Power Production and Distribution		5	3	1	5	1	6	6	3	9	3	3		1	1		47	17%
General Chemistry		3	3	3	7	6	7	1	1		2		1		3	1	38	18%
Industrial Engineering	2	2	6	2	6	4	1	4	4	4		4	4		2	3	48	27%
Lighting/Heating			2	5	1	5	2	2				1	1	1		2	22	23%
Materials Science	2	9	9	20	23	27	18	13	3	6	4	1	1	2	4	8	150	13%
Measurement and Instrumentation	4	15	18	20	21	17	15	6	10	3	1	4	6	5	2	7	154	16%
Mechanical Engineering	2	1					1		2	1					1		8	13%
Medical Technology	2	8	7	9	2	13	11	2	6	4		5	4	5	3	8	89	28%
Optics	1			1		1											3	0%
Paper	1	1		1	1		3	2		2							11	0%
Personal Care			1	2	1	2	6	2		1	2	2			2	4	25	40%
Petroleum	1		1	2	5	1	2	1							1		14	7%
Pharmaceuticals	14	34	35	36	46	44	41	20	11	5	11	9	9	4	8	18	345	17%
Printing & Photography				3			3	1		1							8	0%
Semiconductors and Electronic Circuitry	1	3	4	6	9	3	6	4	3	10	3	4	1			1	58	16%
Textiles						1	2		2		1			1	1		8	38%
Transport/Automotive		2	3	1	1		4	3		1		2	1	1			19	21%
Water Treatment	1	1	1			1	2	1		1						1	9	11%

Above average recency

The following table shows the same activity, normalized by publication year.

Technical Category	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Agriculture and Food	21%	21%	23%	22%	19%	18%	18%	18%	15%	6%	27%	14%	17%	10%	14%	14%
Pharmaceuticals	18%	16%	14%	12%	14%	18%	15%	11%	9%	13%	12%	25%	22%	20%	25%	25%
Biotechnology	21%	14%	13%	12%	17%	17%	15%	14%	12%	14%	15%	6%	9%	12%	20%	20%
Measurement and Instrumentation	6%	9%	12%	12%	9%	7%	7%	5%	13%	4%	2%	6%	11%	12%	3%	5%
Materials Science	3%	6%	6%	12%	10%	11%	8%	12%	4%	8%	10%	2%	2%	5%	7%	6%
Computing and IT	3%	5%	4%	2%	5%	5%	4%	3%	5%	1%	2%	8%	13%	17%	3%	8%
Medical Technology	3%	5%	5%	5%	1%	5%	5%	2%	8%	5%		8%	7%	12%	5%	6%
Chemical Engineering	2%	2%	3%	4%	4%	1%	3%	4%	4%	13%	7%	6%	2%			1%
Industrial Engineering		6%	3%	4%	4%	3%	3%	3%	3%	4%					2%	5%
Communications		3%	2%	1%	2%		3%	5%	4%	12%	7%	5%		2%	2%	
General Chemistry	3%	1%	4%	1%	2%	2%		4%	5%	5%		6%	7%		3%	2%
Semiconductors and Electronic Circuitry	2%	3%	3%	1%	4%	3%	3%	4%	4%	1%		5%	4%			2%
Electrical Power Production and Distribution		2%	2%	2%	3%	2%	3%	1%	1%		5%		2%		5%	1%
Personal Care	3%			1%	1%		1%	1%	5%	5%	5%				2%	
Lighting/Heating			1%	3%		2%	1%	2%				2%	2%	2%		2%
Domestic Appliances and Articles			1%	1%		1%	3%	2%		1%	5%	3%			3%	3%
Petroleum		1%	2%	1%			2%	3%		1%		3%	2%	2%		
Transport/Automotive	6%	3%	1%	1%		1%	1%	2%				2%		2%		
Paper	2%	1%		1%			1%	2%		3%						
Mechanical Engineering			2%	1%	1%			2%	1%							
Textiles	2%		1%	1%	2%		1%	1%							2%	
Civil Engineering	2%	1%	1%				1%	1%		1%						1%
Electrical Devices	3%	1%							3%	1%					2%	
Printing & Photography				2%			1%	1%		1%						
Water Treatment							1%		3%		2%			2%	2%	
Optics	2%			1%												

Several fields do show an incipient recovery. Many of the categories are quite small, including Water Treatment, Mechanical Engineering, but some of the larger categories show this recovery, including:

- Pharmaceuticals
- Biotechnology
- Agriculture and Food

This suggests that the previous changes to NZ patent law are reflected in many of the categories.

GEOGRAPHIC PATENT FILING STRATEGY OF NEW ZEALAND ACADEMIC PATENTS

The tables below show the most popular locations for follow up filing of patents from New Zealand academic institutions.

Interestingly, the United States is now the most popular foreign filing location, with 63% of all New Zealand academic patents also filed here. This is distinct from the previous report, in which Australia was the most common foreign filing partner. Australia is now a filing location in 53% of all New Zealand academic patents. The European Patent Office is, percentagewise, exactly where it appeared in the previous study (52% of filings). The level of US activity points towards the purpose of academic intellectual property: patents filed by universities, unless spun-out into a corporate entity, generally are not asserted to protect sales and market share of a product incorporating the invention. Instead, academic IP is commercialised to allow others to practice the invention – i.e. they are licensed.

Licensees are generally unwilling to pay royalties for patents that have not been at least filed (and preferably granted) in the United States.

Foreign Filing Locales of New Zealand Academic Patent Applicants (5 or more publications)
As % of Total NZ Academic Activity

Foreign Filing Location	Total Patent Families	% of Total NZ Academic Activity
United States	501	63%
Australia	421	53%
European Patent Office	414	52%
Japan	215	27%
China	202	25%
Canada	158	20%
India	107	13%
Spain	81	10%
South Korea	80	10%
Brazil	79	10%
South Africa	65	8%
Mexico	61	8%
Germany	48	6%
Singapore	39	5%
Hong Kong	34	4%
Russia	32	4%
United Kingdom	25	3%
Taiwan	25	3%
Phillipines	17	2%
Israel	13	2%
Indonesia	9	1%
Norway	8	1%
Argentina	7	1%
Vietnam	7	1%
France	6	1%
Eurasian States	6	1%
Malaysia	6	1%

The next table shows the geographic trends within the office filing data.. All the major filing locations (AU, US, EP, JP) show little year on year change in popularity.

However, Chinese patent applications do show a strong tendency to recent years, indicating that Chinese patent protection is of increasing importance.

Foreign Filing Locales of New Zealand Academic Patent Applicants

Time Line of Foreign Filing Locations; Excludes Incomplete Years

Foreign Filing Location	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total All Years	% Recency (since 2014)
United States	19	51	49	50	80	67	61	28	11	19	13	15	15	12	20	34	544	20%
European Patent Office	17	37	44	43	66	54	52	26	9	15	10	9	13	9	17	34	455	20%
Australia	24	49	37	33	54	47	30	20	12	15	9	9	15	12	20	34	420	24%
Japan	9	11	24	22	30	32	28	15	7	10	8	3	7	4	11	13	234	20%
China	3	9	16	16	30	25	26	13	5	13	4	5	12	6	11	23	217	28%
Canada	5	10	10	12	19	22	26	12	5	4	4	6	4	6	13	24	182	31%
India	1	8	11	11	11	16	12	5	3	4	3	2	5	2	6	16	116	29%
Spain	2	6	6	5	9	7	15	4	2	3	3	3	1	5	10	9	90	34%
Brazil	2	8	8	8	10	10	9	7	1	1	1	1	3	2	3	9	83	23%
South Korea	2	2	11	6	10	8	12	9	2	5	2	1		3	4	3	80	16%
South Africa	2	5	7	5	8	6	5	10	1	2	1	1	1		5	3	62	18%
Mexico		2	4	5	9	9	7	8			1	1			5	9	60	27%
Germany	4	7	6	7	7	5	11	2	3		2		1				55	5%
Singapore	1	2	2	4	8	6	3	4	3	2	1		4	1	2	4	47	26%
Hong Kong		1	1	2	3	3	7	4	1	1	1	1	3	1	5	4	38	39%
Russia		2	2	4	6	4	6	3	1		1	1			1	4	35	20%
Taiwan	2		5	2	2	4	2	1	2						2	4	26	23%
United Kingdom	2	1	1	1	6	4	2	1		2		1		1	1	1	24	17%
Phillipines		1	1	1		2	1	2			1			1	3	3	16	50%
Israel		1	1	1			5	1			1	1	2		1		14	36%
Norway				2	3	1	1	2	1								10	0%
Indonesia						2		2				1		1	1	2	9	56%
Argentina					1	1									1	5	8	75%
France		1		1	1	1	3	1									8	0%
Eurasian States		1	1	1		1	1	1							1		7	14%
Vietnam						2		1						1		1	5	40%
Malaysia							3	1							1		5	20%

Above average recency

The following table is again noted by a date normalization per each publication year:

Foreign Filing Locales of New Zealand Academic Patent Applicants

Time Line of Foreign Filing Locations; Excludes Incomplete Years

Foreign Filing Location	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
United States	20%	24%	20%	21%	21%	20%	19%	15%	16%	20%	20%	25%	17%	18%	14%	14%
Australia	25%	23%	15%	14%	14%	14%	9%	11%	17%	16%	14%	15%	17%	18%	14%	14%
European Patent Office	18%	17%	18%	18%	18%	16%	16%	14%	13%	16%	15%	15%	15%	13%	12%	14%
Canada	5%	5%	4%	5%	5%	6%	8%	7%	7%	4%	6%	10%	5%	9%	9%	10%
China	3%	4%	6%	7%	8%	7%	8%	7%	7%	14%	6%	8%	14%	9%	8%	10%
India	1%	4%	4%	5%	3%	5%	4%	3%	4%	4%	5%	3%	6%	3%	4%	7%
Japan	9%	5%	10%	9%	8%	9%	9%	8%	10%	10%	12%	5%	8%	6%	8%	5%
Spain	2%	3%	2%	2%	2%	2%	5%	2%	3%	3%	5%	5%	1%	7%	7%	4%
Brazil	2%	4%	3%	3%	3%	3%	3%	4%	1%	1%	2%	2%	3%	3%	2%	4%
Mexico		1%	2%	2%	2%	3%	2%	4%			2%	2%			3%	4%
Argentina															1%	2%
Singapore	1%	1%	1%	2%	2%	2%	1%	2%	4%	2%	2%		5%	1%	1%	2%
Hong Kong				1%	1%	1%	2%	2%	1%	1%	2%	2%	3%	1%	3%	2%
Russia		1%	1%	2%	2%	1%	2%	2%	1%		2%	2%			1%	2%
Taiwan	2%		2%	1%	1%	1%	1%	1%	3%						1%	2%
South Korea	2%	1%	4%	2%	3%	2%	4%	5%	3%	5%	3%	2%		4%	3%	1%
South Africa	2%	2%	3%	2%	2%	2%	2%	5%	1%	2%	2%	2%	1%		3%	1%
Phillipines						1%		1%			2%			1%	2%	1%
Indonesia						1%		1%					2%		1%	1%
United Kingdom	2%				2%	1%	1%	1%		2%		2%			1%	1%
Vietnam						1%		1%							1%	
Germany	4%	3%	2%	3%	2%	1%	3%	1%	4%		3%		1%			
Israel							2%	1%			2%	2%	2%		1%	
Norway				1%	1%			1%	1%							
Eurasian States								1%							1%	
France							1%	1%								
Malaysia							1%	1%							1%	

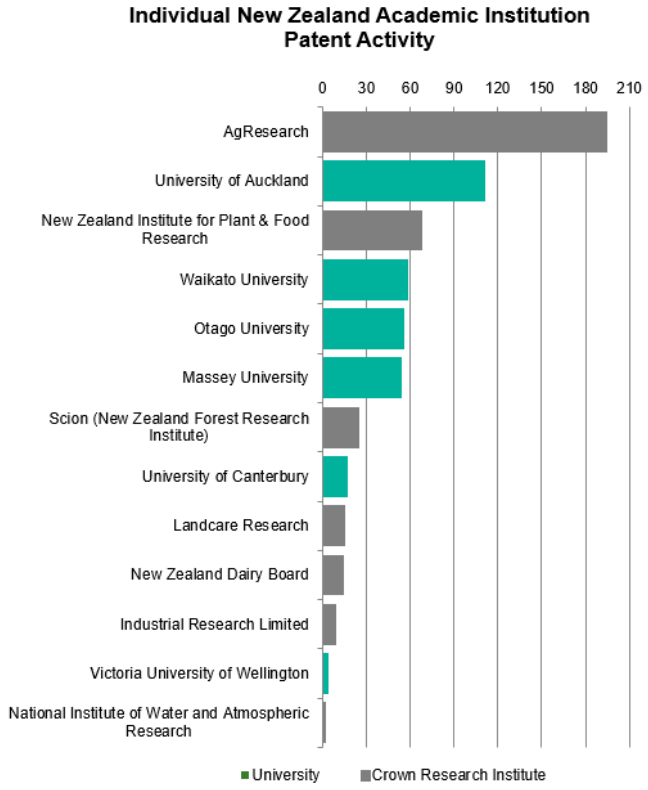
Again, a recent upward trend is seen in most of the countries in which academic entities file for protection.

NEW ZEALAND ACADEMIC ACTIVITY BY INSTITUTION

This section analyses the patent activity of the individual academic institutions in New Zealand. The chart below shows the number of DWPI patent families uncovered in the New Zealand collection for each of the institutions, including records assigned to associated corporate entities and to historical names.

The most prolific institution is the AgResearch Crown Research Institute, followed by the University of Auckland.

Of the top 5 institutions, 2 are CRIs; this shows that the CRI program is having a direct effect on the level of international technology commercialization opportunity for New Zealand.



Timeline of Activity for New Zealand Academic Institutions

Publication year/count

NZ Academic Institution	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Total	% Recency (since 2014)
AgResearch	4	11	8	17	21	15	27	22	9	8	10	3	1	11	12	6	6	12	203	24%
University of Auckland		2	3	17	10	9	12	7	12	10	6	10	7	6	1	1		1	114	14%
New Zealand Institute for Plant & Food Research			1	1	3	2	3	6	6	3	3	4	2	4	1	2	11	17	69	54%
Waikato University	1		4	5	6	2	9	6	4	4	4	5		5		2	1	3	61	18%
Massey University	1	3	4	4	3	3	3	5	4			3	6	1	3	3	3	5	54	39%
Otago University			3	4	6		2	4	2	6	5	1	2	1	2	3	3	9	53	38%
Scion (New Zealand Forest Research Institute)		2	1			1	2	1	2	2	3	3	1			1	4	1	24	29%
University of Canterbury		2	2	4	2	1	1	1		1	3								17	0%
Landcare Research						2	2	2		2	2			2	2			2	16	38%
New Zealand Dairy Board	1	4	2	2	1			1	1	1		1							14	0%
Callaghan Innovation (formerly Industrial Research Limited)			1		1	2	1	3	2										10	0%
Victoria University of Wellington																		3	3	100%
National Institute of Water and Atmospheric Research										1				1					2	50%

Above average recency

The table above shows the timeline of activity for each of the academic institutions. The table is sorted by total inventions.

AgResearch appears to have the most improved recent publishing activity, with a publishing rebound occurring in 2015 and 2016. Publications were lower in the next 2 years, but increase again in 2019. The NZ Institute for Plant and Food Research, with more than 40% of their patents publishing in the most recent 2 complete years, shows very high recent activity.

Timeline of Activity for New Zealand Academic Institutions
Normalized

NZ Academic Institution	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
AgResearch	57%	48%	30%	33%	41%	45%	43%	37%	21%	22%	31%	10%	6%	35%	57%	38%	21%	24%
University of Auckland		10%	11%	35%	20%	27%	20%	12%	29%	30%	19%	34%	44%	19%	5%	6%		2%
New Zealand Institute for Plant & Food Research				2%	6%	3%	5%	11%	14%	8%	9%	14%	13%	13%	5%	13%	39%	33%
Waikato University	14%		15%	10%	12%	6%	15%	11%	10%	11%	13%	17%		16%		13%	4%	4%
Massey University	14%	14%	15%	8%	6%	9%	5%	9%	10%			10%	25%	3%	14%	13%	11%	10%
Otago University			11%	6%	12%		3%	7%	5%	14%	16%		6%	3%	10%	13%	11%	18%
Scion (New Zealand Forest Research Institute)		10%	4%			3%	3%	2%	5%	5%	6%	10%	6%			6%	14%	2%
New Zealand Dairy Board	14%	19%	7%	4%	2%			2%	2%	3%		3%						
Landcare Research							3%	4%		5%	6%			6%	10%			4%
Callaghan Innovation (formerly Industrial Research Limited)			4%		2%	6%	2%	5%	5%									
National Institute of Water and Atmospheric Research										3%				3%				
University of Canterbury						5%	3%	3%		5%	6%			6%	10%			4%
Victoria University of Wellington																		4%

FILING STRATEGIES OF INDIVIDUAL ACADEMIC INSTITUTIONS

The geographic patent filing strategy for New Zealand academic institutions as a unit has been further analysed below at the individual institution level.

The table shows the proportion of each institution's activity filed in each territory.

Australia is evident as a nearly automatic filing location across all the institutions. The University of Auckland does appear to file more of its inventions in the United States than Australia. The European Patent Office also has more filings than Australia for this University.

Nearly all institutions seem to exhibit a broad international filing strategy. The University of Canterbury and Landcare Research appear to be more choosy in their international filings, with fewer foreign entities included in their strategies.

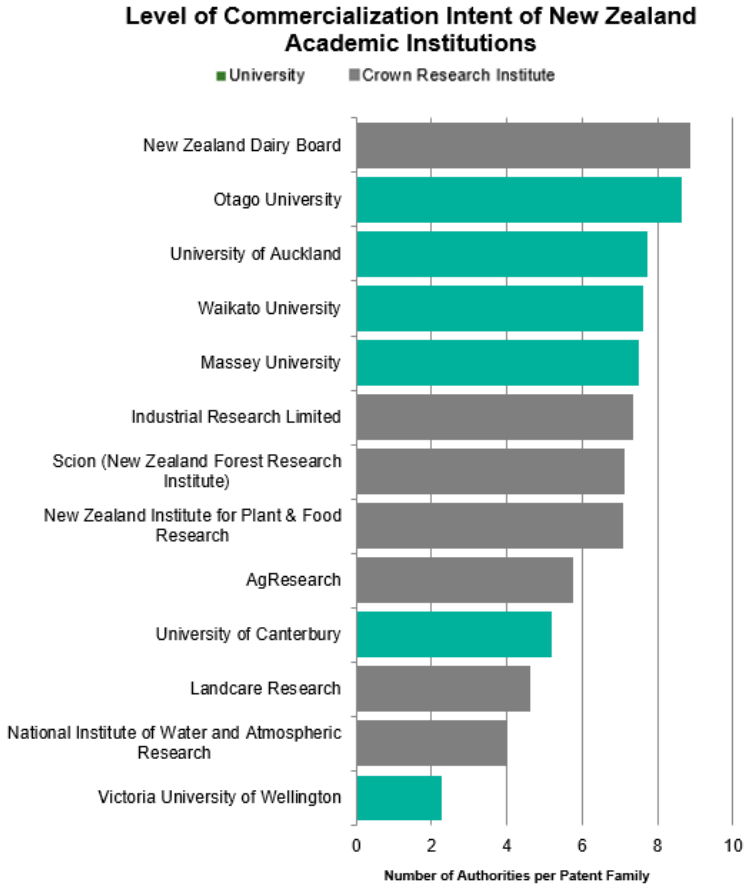
Foreign Filing Locations of New Zealand Academic Institutions

Numerical

Foreign Filing Locale	AgResearch	University of Auckland	New Zealand Institute for Plant & Food Research	Waikato University	Otago University	Massey University	Scion (New Zealand Forest Research Institute)	University of Canterbury	Landcare Research	New Zealand Dairy Board	Industrial Research Limited	Victoria University of Wellington	National Institute of Water and Atmospheric Research
United States	99	78	42	45	40	34	11	12	8	9	8	2	1
Australia	129	42	42	37	36	34	14	7	10	13	8		1
European Patent Office	85	53	40	34	34	25	8	8	4	8	7	1	1
Japan	28	36	16	15	27	13	7	3		6	3		
China	31	30	16	17	24	9	4	3	2	3	2	1	
Canada	13	16	23	8	23	7	9	2	4	2	2		
India	23	12	6	4	15	5	3	1	2	1			
Spain	11	6	15	6	9	7	5	1		4	1		
Brazil	32	6	2	5	3	5	3	1		3	1		
South Korea	6	15	5	4	7	6	3	1		4	1	1	
South Africa	19	7	5	11	2	2	4			1			
Mexico	16	5	4	5	2	2	2			3			
Germany	10	3	1	6	4	1	1			3	1		
Singapore	7	1	1	8	5	5			2				
Hong Kong		3	4	2	2	5	3		2				
Russia	6	4	1			1	3			1			
United Kingdom	9	3		4	1		1						
Taiwan	3	4	5		3					1			
Philippines	1	3	2		1	2	2						
Israel		2				2			2				
Indonesia	1	1	1				3						
Norway							1	1					
Argentina	4		2										
Vietnam			1		1		1						
Eurasian States						2							
France					1								
Malaysia	2						2						
Hungary				2						1			
Denmark			1										

ANALYSIS OF IP COMMERCIALIZATION INTENT AND POTENTIAL OF NEW ZEALAND ACADEMIC INSTITUTIONS

This section of the report looks at the patent portfolios of the New Zealand academic institutions from the perspective of IP commercialization potential.



The above chart shows the average number of patent authorities into which each institution files its patent applications. This measurement can be thought of as a proxy for the level of intention or commitment to patent commercialization.

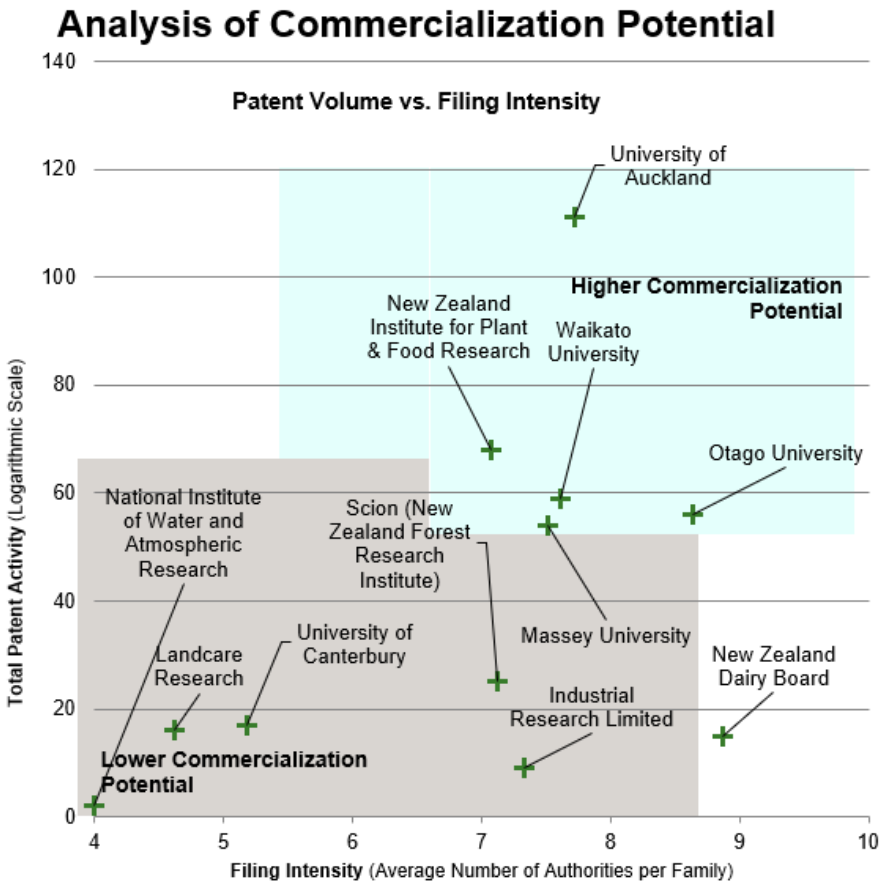
As patent applications represent significant costs to an academic entity, wide filing of patents would not be considered automatic.

The chart shows that, as anecdotally seen in the previous section, that the New Zealand Dairy Board and the University of Otago have particularly strong investments in geographic protection.

However, both of these entities have fewer overall patent families in the dataset than AgResearch, the University of Auckland or Industrial Research Ltd.

To correct for this reduction in volume (and subsequent loss of commercialization potential), the chart below plots the average number of patent authorities in which each institutions' inventions are filed against the total number of inventions.

The resulting pattern can then be divided into two sections – institutions with "high" commercialization potential, i.e. higher than average number of inventions that are in generally more broadly filed, versus "lower" commercialization potential – fewer overall inventions, generally more narrowly filed.



A further analysis of the institutions was undertaken, in which the number patent families in which the IP was in some way entangled (i.e. re-assigned or co-assigned with a for-profit entity, excluding Technology Transfer corporate entities).

These entanglements are shown per university below. Also shown is the straightforward count of entities with which each institution is entangled.

The results of this analysis have then been further annotated as to whether the entity fell into the "higher" section of the commercialization potential chart.

The members of the higher potential section cluster at the top of the top – providing supporting evidence that these institutions have more developed intellectual property strategies.

'ADVERSE' CITATION IMPACT OF ACADEMIC IP ON DOWNSTREAM IP APPLICATIONS

When examination takes place at the European Patent Office or via the Patent Co-operation Treaty fast-track procedure, examiners list their citations to relevant prior art in a document appended to the application – known as the search report.

Beside each cited patent number, the examiner will note the reason for the citation by the addition of a letter. Where the examiners cite with an "X" or "Y" notation, this means that the

prior art removes or reduces the novelty or non-obviousness of the application, i.e. the prior art challenges the overall patentability of the downstream application.

The collection of these "adverse" citation references by individual patents, and thereby by aggregated assignee allows for the overall level of citation impact to be assessed.

The collection of high levels of adverse citation means several things; that the heavily cited IP is broad in scope, and therefore likely to impinge upon many downstream applications; that the IP sits within a very active area. Alternatively, it could just mean that the "blocking" patent is particularly noteworthy in its field.

In any case, the collection of many adverse citations by a patent portfolio is highly desirable, as it means that there are many more potential infringers of your protected technology (the attempt at protection acting a proxy for desire to market a product covered by the technology).

Adverse European and PCT Examination Citation Impact of New Zealand Academic Patent Activity

NZ Academic Institution	Total Adverse Citations Caused	Total Patent Families	Average Years Remaining	Citation Impact per Family	Citation Frequency	Average DSI
AgResearch	74	195	5.90	3.04	0.82	12.39
New Zealand Institute for Plant & Food Research	48	68	9.39	6.52	1.25	28.55
Waikato University	32	59	5.91	2.76	1.04	13.25
Massey University	26	54	5.39	6.08	1.89	17.00
Otago University	18	56	6.31	7.45	2.80	22.83
University of Auckland	12	111	6.42	5.63	2.29	19.91
Scion (New Zealand Forest Research Institute)	11	25	6.29	10.42	3.37	26.14
University of Canterbury	9	17	4.10	10.00	1.25	2.03
Industrial Research Limited	6	9	3.56	6.67	1.73	13.30
Landcare Research	5	16	8.43	4.29	0.74	14.94
Victoria University of Wellington	3	4	18.00	0.00	0.00	42.44
New Zealand Dairy Board	0	15	1.40	3.33	1.19	2.53
National Institute of Water and Atmospheric Research	0	2	8.50	0.00	0.00	15.19

SUMMARY COMPARISON OF NEW ZEALAND ACADEMIC INSTITUTIONS

The final analysis in this chapter summarises the various metrics by which the institutions have been compared into a final ranking.

Summary of New Zealand Academic Institutions

Volume and Quality Metrics Ranking, Overall Score

NZ Academic Institution	Volume Rank	Citation Rank	Technical Collaboration Rank	Filing Intensity Rank	Overall Rank
University of Auckland	2	3	2	2	1
AgResearch	1	10	1	1	2
New Zealand Institute for Plant & Food Research	3	6	2	3	3
Massey University	6	4	5	5	4
Waikato University	4	9	4	4	5
Otago University	5	2	8	6	5
Scion (New Zealand Forest Research Institute)	7	1	7	7	7
New Zealand Dairy Board	10	8	8	8	8
Industrial Research Limited	11	5	9	10	9
Landcare Research	9	11	9	9	10
University of Canterbury	8	7	12	12	11
National Institute of Water and Atmospheric Research	13	12	9	11	12
Victoria University of Wellington	12	12	12	13	13

This process shows the Universities of Waikato, Otago, Auckland and Massey University as having the most polished approaches to technology commercialization.

It is notable that the Crown Research Institutes do less well in this overall analysis than in the volume comparison. This indicates that the CRIs are filing for patents, but are doing less with them than perhaps is ultimately possible. Interestingly, AgResearch has improved from 5th in the previous study to second position, and that the NZ Institute for Plant & Food Research has also improved from 7th position to 3rd, suggesting that the CRIs are becoming more prominent on the global stage.

It also reveals that there are two approaches to academic TTO: high volumes of patents versus careful selection of specific patents which are then invested in more heavily.

Review of the measurements in this study appears to point to the latter strategy as more effective when it comes to successful technology transfer.

The quality and breadth of the patents

PART 3 – ANALYSIS OF NEW ZEALAND INTELLECTUAL PROPERTY STRENGTH

The final chapter of this report benchmarks the foreign, domestic and NZ academic patent collections against each other using four patent quality metrics:

- Grant success in Europe, the United States and Australia.
- Quadlateral patent filing activity – patent families filed in Europe, the United States, Japan and China
- Technical Breadth – the number of DWPI classes (high level technical classifications) per patent family.
- The Derwent Strength Index[10]

QUADRILATERAL ANALYSIS OF DOMESTIC NEW ZEALAND PATENT ACTIVITY BY TECHNICAL FIELD

The first analysis benchmarks domestic New Zealand patent activity by technology area, measuring the proportion of patent families that have been filed internationally.

[10] The *Derwent Strength Index* is a metric that assesses several desirable characteristics a single invention has gathered to date. It is aggregated across technologies and entities to identify trends and direction. The *DSI* assesses:

- The frequency of downstream citation to an invention – a well known metric of impact and importance
- The breadth of geographic filing, which correlates very closely to the level of cost and investment in patent protection
- Existence and location of granted, issued patent rights, a proxy for validity as well as commitment by the patent applicant
- The invention's technical breadth, correlating to the range of industry which the invention maps on – essentially, how "big" the invention is

In addition, the *Derwent Strength Index* also models the value of inventions over time.

Quadlateral (EP, US, JP and CN) Filed Domestic New Zealand Patent Activity

By Technical Field

Technical Category	Number Filed Quadlaterally	Total Domestic NZ Families	% Quadlateral
Personal Care	17	57	29.8%
Petroleum	9	50	18.0%
General Chemistry	19	106	17.9%
Printing & Photography	8	48	16.7%
Pharmaceuticals	107	697	15.4%
Biotechnology	51	345	14.8%
Optics	8	55	14.5%
Paper	10	72	13.9%
Semiconductors and Electronic Circuitry	17	137	12.4%
Electrical Power Production and Distribution	23	206	11.2%
Electrical Devices	16	149	10.7%
Materials Science	77	743	10.4%
Medical Technology	50	541	9.2%
Textiles	6	66	9.1%
Chemical Engineering	10	123	8.1%
Measurement and Instrumentation	29	394	7.4%
Mechnical Engineering	38	573	6.6%
Industrial Engineering	87	1394	6.2%
Transport/Automotive	25	492	5.1%
Computing and IT	37	736	5.0%
Agriculture and Food	67	1375	4.9%
Communications	22	456	4.8%
Domestic Appliances and Articles	40	870	4.6%
Lighting/Heating	12	294	4.1%
Civil Engineering	32	1170	2.7%
Water Treatment	2	90	2.2%

Low Volume, Widely Filed Categories

High Volumes of Quad Filing:

- Industrial Engineering
- Pharmaceuticals
- Agriculture and Food
- Domestic Appliances and Articles
- Materials Science
- Civil Engineering

The international nature of patented inventions uses the quadlateral patent application method – i.e. checks for patent applications that have simultaneously filed in four worldwide patent authorities – China, Europe, USA and Japan.

These four patent issuing authorities require locally certified legal counsel and at least 3 certified translations of the draft patent to be performed – incurring significant cost to the applicant.

Therefore, it is assumed that this level of investment is only performed on inventions of high quality, where commercialization returns are highly probable or where the invention is of a highly strategic nature.

QUADRILATERAL ANALYSIS OF DOMESTIC NEW ZEALAND PATENT ACTIVITY BY DOMESTIC PATENT APPLICATION

Quadlateral (EP, US, JP and CN) Filed Domestic New Zealand Patent Activity
By New Zealand Domestic Entities (>3 Quad Filings)

Assignee	Number Filed Quadlaterally	Total Domestic NZ Families	% Quadlateral	Top Technical Field
Bristol-Myers Squibb	2	2	100.0%	Pharmaceuticals
Novartis	4	7	57.1%	Pharmaceuticals
Bayer	1	2	50.0%	Pharmaceuticals
NZ Dairy Board	7	17	41.2%	Agriculture and Food
Fonterra Coop	17	56	30.4%	Agriculture and Food
WaikatoLink	4	17	23.5%	Pharmaceuticals
Fisher & Paykel	9	39	23.1%	Pharmaceuticals
University of Auckland	20	103	19.4%	Domestic Appliances, Personal Care
University of Waikato	3	17	17.6%	Pharma, Biotech, Agriculture & Food
Corcel IP	5	29	17.2%	Agriculture and Food
Dow	1	6	16.7%	Manufacturing, Construction
Massey University	2	19	10.5%	Pharmaceuticals
AgResearch	7	72	9.7%	Agriculture and Food
Industrial Research	6	63	9.5%	Pharmaceuticals, Chemistry
Fletcher Building	1	26	3.8%	Manufacturing, Construction

The table above shows the domestic patent assignees with high proportions of quadlateral filing activity. The table has been annotated with the technical fields into which each assignee's patent families have been classified.

This analysis indicates that Pharmaceuticals, Agriculture and Food are a specialization of New Zealand companies, demonstrating a strong export capability.

STRENGTH FACTOR ANALYSIS OF NEW ZEALAND PATENT APPLICATIONS

This final section of the survey summarises the quadlateral filing activity, grant success and technical breadth of the 3 types of New Zealand patent applicant compared: foreign New Zealand applications; domestic applications and domestic academic applications.

Individual academic institutions are also listed for direct identification of strength at an institution level.

The first analysis compares the rates of quadlateral (EP-US-JP-CN) patent filing.

Domestic entities perform this type of international patent application rarely – on just 6% of inventions, compared to also 60% of the time for foreign applicants; this statistic reflecting the strategic invention nature of patents filed in New Zealand by foreign entities.

New Zealand Academic patent applicants filed quadlaterally more often; and specifically, this is mostly performed by three institutions: The Universities of Waikato, Otago and Auckland.

Quadlateral (EP, US, JP and CN) Filing Investment Levels by Source of New Zealand Patent

Patent Family Type	Total Filed Qualaterally	Total	% Quadlateral
All New Zealand Patents	28703	54569	52.60%
NZ Foreign	27590	46388	59.48%
NZ Domestic	381	6137	6.21%
NZ Academic	126	793	15.89%
University of Auckland	24	112	21.43%
AgResearch	18	191	9.42%
Otago University	17	51	33.33%
Waikato University	9	58	15.52%
New Zealand Institute for Plant & Food Research	6	66	9.09%
Massey University	6	51	11.76%
Scion (New Zealand Forest Research Institute)	3	24	12.50%
New Zealand Dairy Board	3	15	20.00%
Industrial Research Limited	2	9	22.22%
Landcare Research		14	0.00%
National Institute of Water and Atmospheric Research		2	0.00%
University of Canterbury		2	0.00%
Victoria University of Wellington		2	0.00%

The next factor for comparison is the success of the three applicant types in achieving granted patent status in either Australia, the US or at the European Patent Office.

Domestic New Zealand applicants perform poorly in this outcome measurement, with just a fifth of inventions achieving this success.

New Zealand academic entities perform better, perhaps due to the wider nature of filing from these institutions.

Patent Family Type	Total Families with a Grant in EP, US or AU	Total Families	% Grant Success
All New Zealand Patents	39309	54569	72%
NZ Foreign	37492	46388	81%
NZ Domestic	1267	6137	21%
NZ Academic	298	793	38%
AgResearch	83	195	43%
Auckland Uniservices	2	111	2%
New Zealand Institute for Plant & Food Research	42	68	62%
Waikato University	18	59	31%
Otago University	33	56	59%
Massey University	21	54	39%
Scion (New Zealand Forest Research Institute)	14	25	56%
University of Canterbury	7	17	41%
Landcare Research	10	16	63%
New Zealand Dairy Board	2	15	13%
Industrial Research Limited	7	9	78%
Victoria University of Wellington		4	0%
National Institute of Water and Atmospheric Research	1	2	50%

The next benchmark assesses the breadth of technology covered on average by inventions from the 3 applicant groups.

This measurement counts the number of DWPI classes applied to each patent by Clarivate Analytics DWPI editorial staff. DWPI classifications are wider than International Patent Classifications as they routinely index mentioned or implied uses of the patent in addition to the claimed invention. For example, patents from the Boeing Corporation would almost certainly be assessed for inclusion in a transportation category, even if the patent makes little or no mention of aerospace applications of the patented technology.

Therefore, this measurement can be used as a proxy for the commercialization potential of an individual patent – the wider the scope of the protected technology, the more opportunity the patent has of being infringed by others.

On this score, New Zealand academic entities routinely score higher than foreign applicants; implying that the patents from the New Zealand universities and Crown Research Institutes cover more technology per invention, and therefore are applicable to wider markets.

Domestic applicants however once more score lower than foreign applicants.

Technical Breadth of Patent Families by Source of New Zealand Patent

Count of DWPI Technical Classes applied to Patent Family

Patent Family Type	Average Technical Breadth of Patent Families
All New Zealand Patents	2.42
NZ Foreign	2.44
NZ Domestic	2.29
NZ Academic	2.92
Scion (New Zealand Forest Research Institute)	3.75
Massey University	3.33
AgResearch	2.99
Otago University	2.86
Waikato University	2.81
New Zealand Institute for Plant & Food Research	2.80
University of Auckland	2.71
Landcare Research	2.14
National Institute of Water and Atmospheric Research	2.00
New Zealand Dairy Board	1.73
Industrial Research Limited	1.67
University of Canterbury	1.50
Victoria University of Wellington	1.00

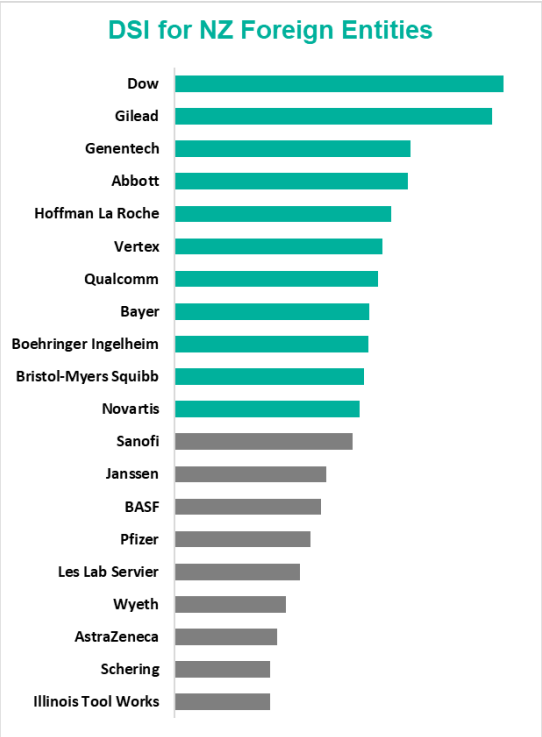
Measure of Cross-Disciplinarity of Work

PART 4 - DERWENT STRENGTH INDEX (DSI) ANALYSIS

The following section covers the various types of analysis through the Derwent Strength Index. As described above, the DSI takes multiple factors previously discussed into account to formulate a "unified" score for each invention. These scores can then be aggregated to allow for a more holistic look at individual assignees, technical categories, etc.

Derwent Strength Index for NZ Foreign

Assignee	DSI	# of patent families
Dow	56.78	268
Gilead	54.82	213
Genentech	40.85	276
Abbott	40.40	243
Hoffman La Roche	37.49	421
Vertex	35.94	218
Qualcomm	35.23	232
Bayer	33.71	405
Boehringer Ingelheim	33.55	484
Bristol-Myers Squibb	32.73	270
Novartis	32.01	752
Sanofi	30.72	523
Janssen	26.25	527
BASF	25.38	339
Pfizer	23.52	440
Les Lab Servier	21.63	238
Wyeth	19.29	214
AstraZeneca	17.82	525
Schering	16.60	240
Illinois Tool Works	16.53	356



The table on the right shows the DSI value for each of the top assignees in the foreign entity analysis. The chart to the right shows the scores for each entity, organized by overall strength score. Entities in teal represent portfolios with an above average (for the top entities) DSI, and those in grey are below average DSI strength. With the exception of Dow (predominantly invested in chemistry), all of the above-average entities are pharmaceutical companies. The lowest scoring entity, ITW, may be more of a reflection on the older nature of the inventions, as amount of enforceable time remaining is a factor in the calculation of DSI.

DSI for NZ Domestic Categories

Category	DSI	# of patent families
Petroleum	20.83	50
Personal Care	20.51	57
Textiles	20.12	66
Printing & Photography	19.26	48
Materials Science	17.71	743
Semiconductors and Electronic Circuitry	17.41	137
Electrical Devices	17.33	149
Electrical Power Production and Distribution	17.12	206
Paper	16.98	72
General Chemistry	16.89	106
Medical Technology	15.73	541
Chemical Engineering	14.58	123
Measurement and Instrumentation	14.27	394
Optics	14.25	55
Biotechnology	14.02	345
Nucelonics, Explosives, Protection	13.71	12
Pharmaceuticals	13.14	697
Communications	12.98	456
Mechnical Engineering	12.98	573
Transport/Automotive	12.15	492
Industrial Engineering	11.68	1394
Computing and IT	11.66	736
Lighting/Heating	11.50	294
Agriculture and Food	11.33	1375
Water Treatment	11.08	90
Civil Engineering	10.26	1170
Domestic Appliances and Articles	9.95	870

DSI for ALL NZ activity

Category	DSI	# of patent families
Biotechnology	35.89	8456
Materials Science	33.86	10909
Personal Care	33.50	1160
Chemical Engineering	33.04	1482
Optics	32.91	464
Textiles	32.72	731
Petroleum	32.69	1064
Nucelonics, Explosives, Protection	32.25	259
Electrical Power Production and Distribution	31.82	1590
Printing & Photography	31.71	979
Semiconductors and Electronic Circuitry	31.41	856
Pharmaceuticals	31.22	22771
Medical Technology	30.38	5724
Measurement and Instrumentation	30.35	3111
General Chemistry	29.79	2077
Paper	28.40	823
Computing and IT	28.23	5167
Communications	28.14	3214
Agriculture and Food	27.62	9215
Electrical Devices	27.22	885
Water Treatment	25.25	623
Mechnical Engineering	23.06	2826
Lighting/Heating	22.64	1726
Industrial Engineering	22.58	8277
Transport/Automotive	21.91	2032
Domestic Appliances and Articles	20.03	3821
Civil Engineering	17.70	4217

DSI for NZ Academic

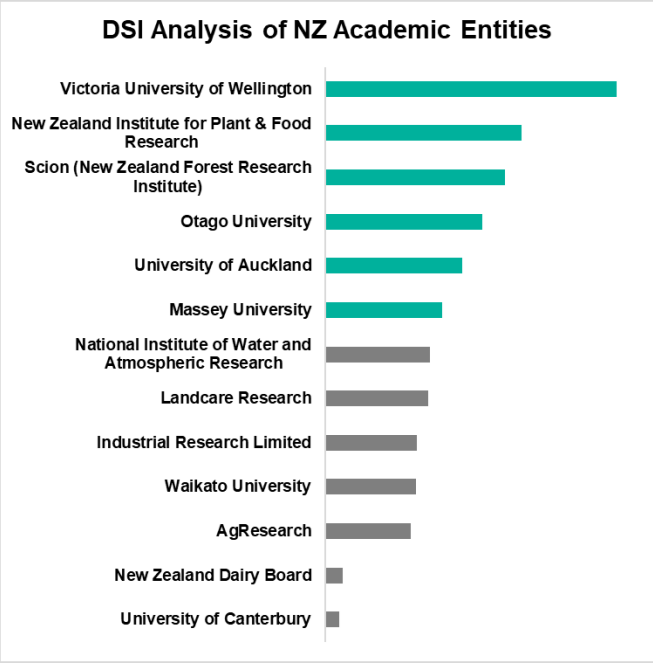
Category	DSI	# of patent families
Personal Care	33.58	16
Paper	30.76	7
Semiconductors and Electronic Circuitry	30.22	24
Petroleum	29.55	8
Computing and IT	28.09	64
Transport/Automotive	26.57	8
Medical Technology	25.99	62
Chemical Engineering	25.32	43
Electrical Devices	25.29	5
Industrial Engineering	24.27	32
Materials Science	24.24	98
Electrical Power Production and Distribution	23.44	16
Communications	22.51	31
Measurement and Instrumentation	22.16	104
Biotechnology	22.08	204
Agriculture and Food	21.72	233
General Chemistry	20.94	28
Pharmaceuticals	19.26	232
Lighting/Heating	19.23	12
Mechnical Engineering	16.15	6
Textiles	15.36	6
Water Treatment	13.19	4
Domestic Appliances and Articles	12.87	10
Printing & Photography	11.12	5
Optics	6.82	1
Civil Engineering	6.67	5

A high-level view of the DSI scores across the three categories of interest in the study (NZ Domestic filings, All NZ filings, and NZ Academic) aligns well with other observations seen throughout the study. Generally speaking, NZ Domestic categories score at a lower level than those seen from all NZ patents. This is likely based on the more local nature of New Zealand filing practice, with fewer international family members being part of the strategy. Additionally, there may be less access to New Zealand patent data (despite its inclusion in global databases like Inpadoc and DWPI), meaning that these patents rarely appear as citations in prosecution of other patents. These two components are key metrics in calculating the Derwent Strength Index, and likely have a negative impact on these scores.

All New Zealand patents are predominantly from entities with a strong global filing strategy. This is likely the main factor in the higher overall DSI across the categories. As has been previously discussed, entities will generally not file in a jurisdiction in which they do not intent do practice, so it is assumed that inventions filed in New Zealand represent inventions with high global commercial potential.

Academic category strength, however, outpaces that seen in Domestic patent publications. This aligns with the observations in the components which combine to make up the Derwent Strength Index.

Institution	DSI	# of patent families
Victoria University of Wellington	42.44	2
New Zealand Institute for Plant & Food Research	28.55	66
Scion (New Zealand Forest Research Institute)	26.14	24
Otago University	22.83	51
University of Auckland	19.91	112
Massey University	17.00	51
National Institute of Water and Atmospheric Research	15.19	2
Landcare Research	14.94	14
Industrial Research Limited	13.30	9
Waikato University	13.25	58
AgResearch	12.39	191
New Zealand Dairy Board	2.53	15
University of Canterbury	2.03	2



Academic strength scores need a bit of context. Victoria University of Wellington has the highest overall DSI score, but this is based on only 2 patent families, so may be heavily influenced by a single invention. In fact, the highest separate component in the calculation is Average Years Remaining, at 18 years. The New Zealand Institute for Plant & Food Research does well, with a score in the high 20s based on a volume of 66 patent families. NZIPFR has one of the most diverse filing strategies, with significant investment in China, Japan, and, notably, Canada. Scion similarly shows a broad international strategy, as well as the highest citation impact and frequency across all academic portfolios.

One drag on the overall scores of New Zealand academic institutions is the remaining enforceability of their portfolios. With the exception of Victoria University of Wellington, all of the institutions in the study have, on average, fewer than 10 years of enforceability in their portfolios. As has been seen across the entirety of New Zealand patents, this is most likely a

reflection on the pendency issues seen as a result of the changes in New Zealand patent law, resulting in far lower numbers over recent years.

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