Review of the New Zealand Product Accelerator

An assessment of its performance, value and optimum role in growing the value and commercial success of New Zealand's manufacturing sector

9 October 2023

This report was co-authored by Sapere and ThinkPlace

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This is a public version of a report submitted to the Ministry of Business, Innovation and Employment. It withholds the review team's analysis of future state options and recommendations for expanding the New Zealand Product Accelerator to protect the confidentiality of advice.

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Executive summary

Background

The New Zealand Product Accelerator (the NZPA) is a publicly funded research network run out of the University of Auckland. It was established in 2009 as the 'Materials Accelerator' and was renamed to the NZPA in 2013. The NZPA includes a core team at the University of Auckland that does upfront engagement work with businesses to help define their R&D needs, and expert researchers at eight institutions who receive a small amount of funding to provide on-call research capacity for the NZPA's clients.

The Ministry for Business, Innovation and Employment (MBIE) commissioned Sapere Research Group and ThinkPlace New Zealand in June 2023 to conduct a review of the NZPA. The review aims to further understand the NZPA's current role in New Zealand's advanced manufacturing ecosystem and identify what its optimal role could be in the future.

The review comes at an opportune time given the New Zealand Government's approach to shaping a prosperous future for New Zealand through supporting partnership between public and private sectors and making it easier for researchers and innovators to take their ideas to market.. Strengthening the connections between advanced manufacturing businesses and the science and research system is an effective way to boost the commercial success of New Zealand's manufacturing sector – a natural hub for New Zealand's innovative potential. Furthermore, given that the advanced manufacturing sector is the second-largest employer of Māori and contains 870 Māori-owned businesses, transforming this industry is a perfect opportunity to improve the protection of Māori manufacturers' Tino Rangatiratanga, as agreed in Te Tiriti o Waitangi.

Current state – the NZPA is playing a valuable role increasing commercial R&D

To understand the NZPA's fit in the research, science and innovation ecosystem we conducted 33 interviews, facilitated two workshops and surveyed clients of the NZPA (120 responses) as well as manufacturing businesses who had not used the NZPA's services (31 responses).

Through our review, we validated that the NZPA has a crucial role to play in New Zealand's advanced manufacturing ecosystem. Our interviews with businesses and researchers confirmed that smaller businesses face significant hurdles in accessing the science and research they need to address practical problems and to commercialise innovative ideas.

The NZPA plays the role of a 'broker' in New Zealand's innovation ecosystem. This role involves bridging the divide between business and research (to 'unlock' connections and opportunities for businesses), de-risking the step of investing in R&D, and supporting those researchers looking to focus their knowledge and skills on applied research with commercial outcomes. However, the NZPA's value is not limited to purely a brokerage role. Part of its funding is used for researchers within the network to conduct research and deliver projects.

There are currently a very small number of organisations who offer this intermediary service in New Zealand, particularly those who are agnostic to industry, profit and the research-model. The NZPA excels in this brokering role. The key to their value proposition and point of difference is not so much what they offer, *but how they offer it* – their accessible costs, collaborative mindset, flexible IP policy and institutional knowledge. It is these crucial factors that get businesses and research institutions over the line and keep them coming back.

We are confident the NZPA is having a material impact on the performance of advanced manufacturing businesses in New Zealand and that the spillover benefits from its activities far exceed the $2.1 million spent annually on the programme. It is providing a highly valuable service that provides much-needed support to New Zealand advanced manufacturing businesses. Its activities generate significant commercial opportunities for businesses and help to reorient important parts of the research, science, and innovation system towards research that has commercial applications. Over time, these benefits are likely to generate spillover benefits to the wider New Zealand economy and it is our conclusion that many of these benefits would have been unlikely to be achieved without the NZPA.

Future state analysis – additional investment in the NZPA is justified

Key policy issues that need to be considered

While the NZPA is offering an important and valued service, we have identified some pressing issues that policy makers need to explicitly take into account when considering the future of the NZPA.

The most pressing issue is that, without additional funding, the NZPA is unlikely to have a viable model beyond the next 18 months. From January 2025 the University of Auckland will substantially increase the overheads fee it levies on the NZPA, which will force the NZPA to cut its activities by approximately 30%. The subsequent cuts that would need to be made to the research network and the core operational team will compromise the ability of the NZPA to offer a service that meets the needs of businesses. An increase in baseline funding of $800,000 is needed simply to maintain historic levels of activity.

We also identified that the NZPA's activities are severely constrained by its current levels of funding. It is being asked to do more with less (with a 25% real budget decrease since 2013), in the face of what appears to be some very significant opportunities to support the growth of advanced manufacturing. The lack of funding means the NZPA has expertise gaps in the research network it cannot address and that it cannot undertake succession planning to reduce its reliance on key individuals. Awareness of the NZPA amongst manufacturing business remains very low and there is likely to be unmet demand from both businesses and researchers.

Despite a long-standing relationship with the University of Auckland, where the current NZPA model is run out of, it is a somewhat uncomfortable fit for a national network with a heavy focus on business engagement and commercialisation. It results in additional overheads costs, limits the ability of the core NZPA team from being staffed with non-university staff who might have relevant business or research skills, and creates a risk should the interests of the University of Auckland and the NZPA diverge over time. Nevertheless, the current model is working well and there is value in the NZPA being embedded within a university ecosystem. We recommend the NZPA and Callaghan Innovation

develop a business case that explores in detail the potential benefits and risks of setting the NZPA up as an independent legal entity. We note that this legal entity would still maintain a close relationship with the research institutions.

Another issue is the extent to which the NZPA should be given a mandate to play a more proactive role in trying to match business and researcher interests to tackle some of the broader manufacturing and societal challenges (a workstream it terms as its "Tomorrow's Economy" vision). Our view is that the NZPA staff will necessarily gain unique insights into the areas where there are clusters of aligned interests among businesses and researchers – and that where it sees the potential for collaboration opportunities it should pursue them. A wholesale shift in the NZPA's focus has the potential to destabilise what it currently provides to the advanced manufacturing sector and would potentially create duplication or increased tension within New Zealand's research, science and innovation ecosystem. While we see the merit in New Zealand pursuing "Tomorrow's Economy" opportunities, the role of the NZPA relative to other agencies is not yet clear and would require more detailed analysis and design.

Recommended options for change

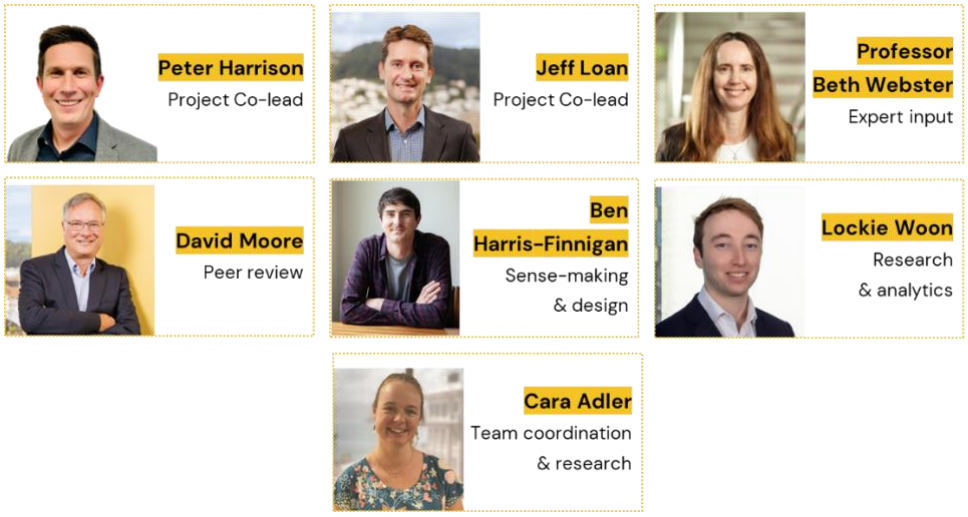
[withheld to protect the confidentiality of advice]

Operational improvements

We have also made some suggestions for operational improvements for the NZPA team and Callaghan Innovation to consider. One area that could be strengthened, particularly if the NZPA receives an increase in funding, is to introduce performance measures to allow the NZPA to understand the impact of its activities. This should include, for example, post-project surveys of clients and researchers to capture insights on the NZPA's activities, estimated value-add, risks averted, satisfaction levels, and company demographics. The NZPA should also be undertaking a regular comprehensive 'census' of all businesses, researchers and students who have participated in an NZPA project to track their performance and careers over time – to help determine the long-term impact of the NZPA support. Another opportunity that additional funding would allow is the development of a service model that caters to the needs of Māori and Pacific businesses. We acknowledge that these additional improvements would likely require funding over and above their current budget and what is costed into our options.

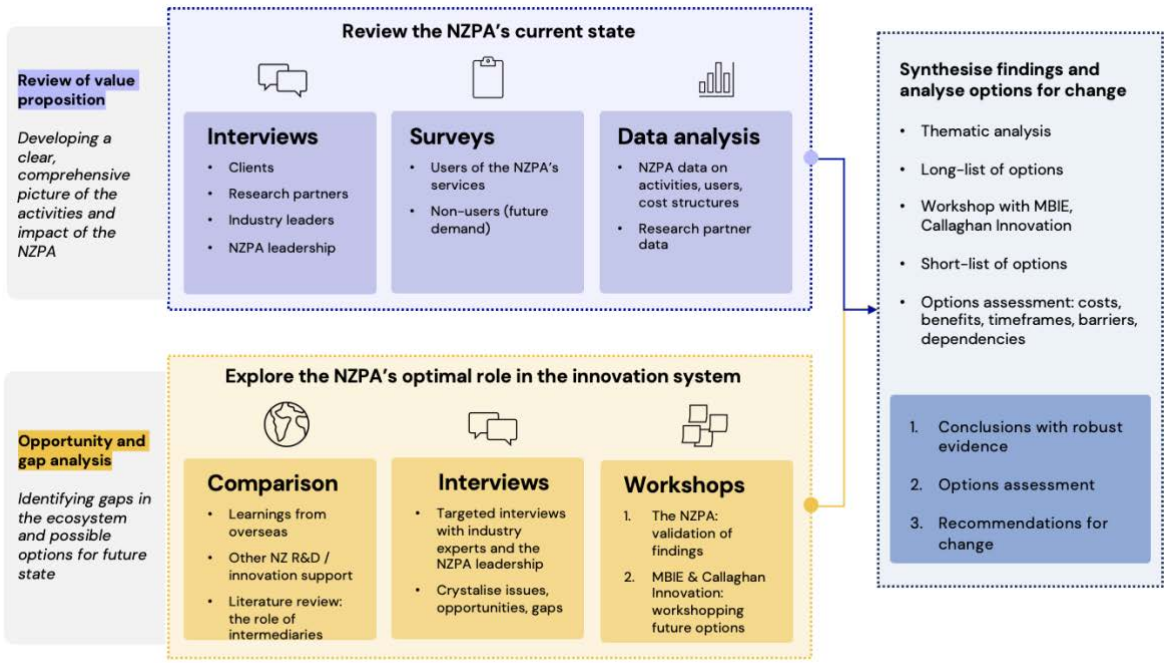
Project team

We operated a single, integrated team of experts from Sapere and ThinkPlace that leveraged our respective knowledge and skills. The team consisted of:



Our approach

Our approach consisted of three core phases as detailed in the diagram below. We simultaneously reviewed the NZPA's current state to understand the current value proposition and explored the NZPA's optimal role in the innovation system to identify opportunities and gaps. In many cases, people we spoke with as part of interviews provided perspectives on both aspects. We then synthesised the finding and analysed options for change.



Chapter 1

Current State

1.1 About the NZ Product Accelerator

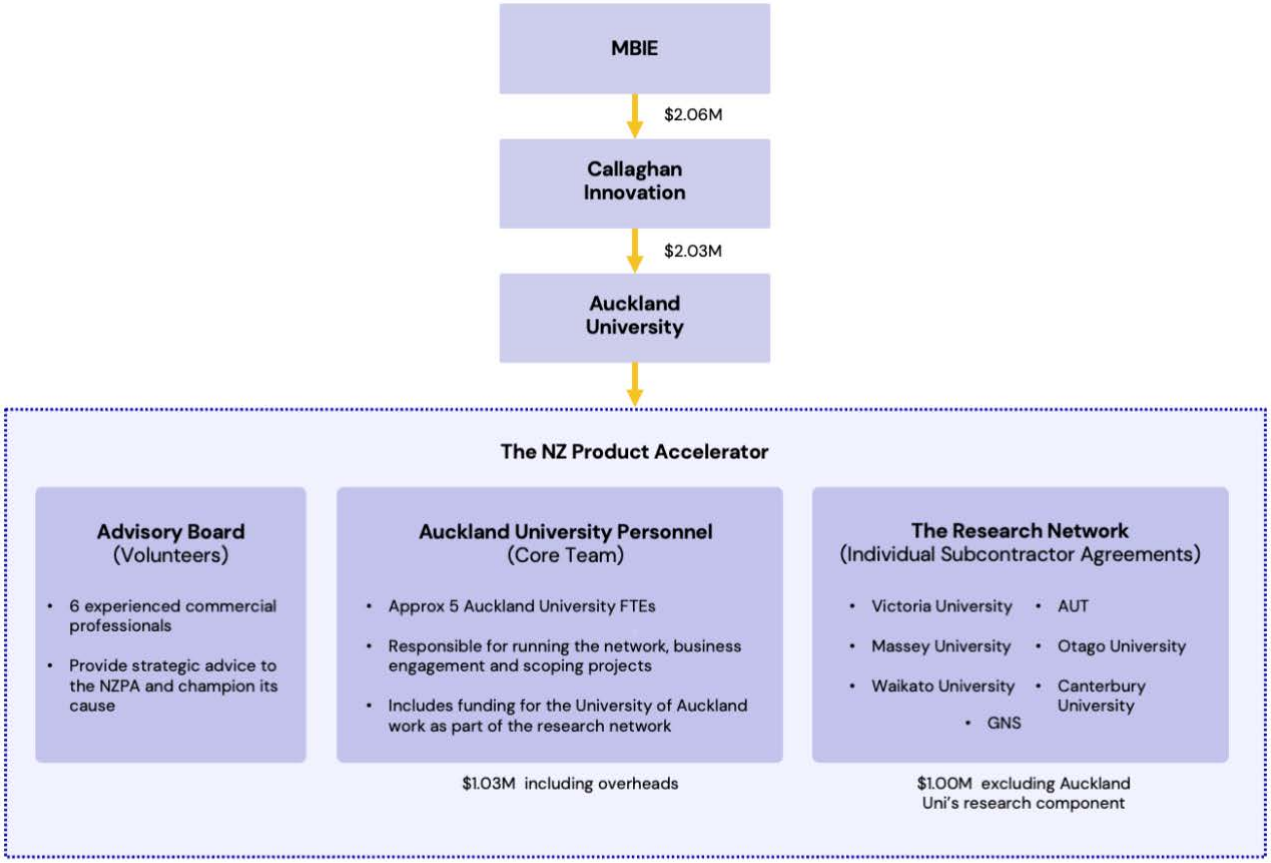
The NZPA is a programme to accelerate the development and growth of New Zealand's advanced manufacturing sector through collaborative research projects with leading materials-based manufacturers. It was designed to support advanced manufacturing companies to create new products, market opportunities and to grow New Zealand's exports. It has three primary objectives:

1. Connecting New Zealand businesses with the best science and technology teams from across its network.
2. Assisting businesses with new product development, problem-solving, and embedding technology innovation
3. Providing the "missing science" in the research and development ecosystem

History and operating model

The NZPA was originally known as the Materials Accelerator and was created from an MBIE Transformational Research, Science and Technology Grant that Mark Taylor and Ralph Cooney applied for and were awarded. The program was originally materials-specific and set up to benefit Advanced Manufacturing.

The NZPA is not a legal entity, but is a brand name for a series of activities undertaken with the baseline funding. The funding of $2.03 million is provided by Callaghan Innovation to the University of Auckland[1], which works with the NZPA management team, through UniServices, to manage and distribute the budget.



Because the NZPA is not its own entity, **the core NZPA team must be employees of the University of Auckland.** Each employee has their individual NZPA commitments written into their Individual Employee Agreements, and the FTE allocation to the program differs per person. The management team and project leads run the programme, including managing the research network and doing engagement work with businesses to help define their research requirements before facilitating the set-up of projects.

The NZPA is a network of some of the leading experts in New Zealand in fields with direct commercial applicability to advanced manufacturing. Again, **because the NZPA is not a legal entity and**

[1] Callaghan Innovation's allocation of funding for the NZPA is prorated from the amount Callaghan Innovation receives for both the NZPA and the Bioresource Processing Alliance (as Callaghan Innovation's funding is not disaggregated for either).

therefore cannot hire its own staff, the University of Auckland has subcontractor agreements with seven research institutions to assist with the delivery of the NZPA programme. The funding agreements vary considerably, ranging from approximately $90,000 to $200,000 per year. Funding is based loosely on the number of staff at each institution that have committed (and are able to be funded) to work with the NZPA.

Each institution in the network is represented by at least one **Network Lead** who works closely with the NZPA core team, including attending weekly operations meetings. These network leads are also known to have relevant subject matter expertise and the skills and personality to facilitate connections between businesses, researchers within their institutions, and the NZPA network.

Each network lead has discretion over how to spend their funding allowance. The funding is typically used to 'purchase' part of an academic's time to dedicate to an NZPA project (often 0.1 of an FTE), to support research students to work on the NZPA projects (through funding Masters/PhD fees, stipends and part-time research assistant jobs), and to facilitate access to materials and university equipment (e.g. 3D printers).[2]

At present, the NZPA has **six research portfolios**, some of which have more than one research lead in specific areas:

- Design Innovation
- Energy and Emissions
- Manufacturing Systems
- Materials and Surfaces
- Sensing and Automation
- Soft Materials, Recycling and Bioprocessing

Recently, 0.5 of an FTE has been allocated to an **employee of Auckland Uni-Services to act as the Research Coordinator for the NZPA**. Of all the programs that Auckland Uni-Services manages, the NZPA is the only one that builds individual budgets and contracts with businesses for each project. The budgets are so individualised to suit each business' needs that Uni-Services needed to dedicate sufficient time to managing this. **The NZPA directors expressed their gratitude for Uni-Services recognising the NZPA's industry-led style in this way.**

The NZ Product Accelerator's engagement model

The NZPA has defined a four-stage model for supporting businesses through the R&D process:

1. **Engage**: initial conversations are held with a business about its needs and opportunities. Depending on the context a project team may be formed to examine a topic in detail.

[2] We note that the use of University, CRI or other resources for commercial projects is never subsidised – this is neither possible or desirable since these resources require maintenance and improvement over time.

2. **Define**: a clear project scope will be developed defining the opportunity and what is needed from both the business and the NZPA to ensure success.
3. **Connect**: the business is connected to researchers and those outside of the network who may be able to help. The NZPA researchers may be involved in these scoping discussions and early testing.
4. **Deliver**: a project team (typically led by a Project Lead and comprising researchers and business representatives) gets to work exploring and delivering on the opportunity. The relationship may tend towards becoming a bilateral one between the business and a research institution at this point, where there will be direct cost payment or some form of financial contribution from the business to the institution (either a fee-for-service or an IP-sharing arrangement).

This model reinforced what we heard from our interviews, that the NZPA is more than simply a front-door for businesses to access research expertise. Its investment in the upfront engagement phase with businesses enables it to play an important intermediary or brokering role, which in over half of engagements, extends to delivery of the results required by the business.

The NZ Product Accelerator's activities

The following metrics provide an insight into a typical year for the NZPA:

	4 year total (July 2019 –June 2023)	Annual average
New engagements with businesses	406	101
New research projects initiated	213	53
Research projects completed	186	47
Research project revenue generated by research institutions (partners)	$6,823,960	$1,705,990
Average project research expenditure (the NZPA, research institution and commercial funding)	($6,823,960 / 213)	$32,037
Research projects with commercial funding	(163 / 213)	77%
Average commercial contribution to a research project	($6,305,960 / 163)	$38,687
Proportion of commercial projects that have an estimate of the 'Potential Value of Product'	(69 / 163)	42%
Clients' estimate of the Potential Value of Product for commercially funded projects (supplied by the NZPA)	$984 million	$246 million

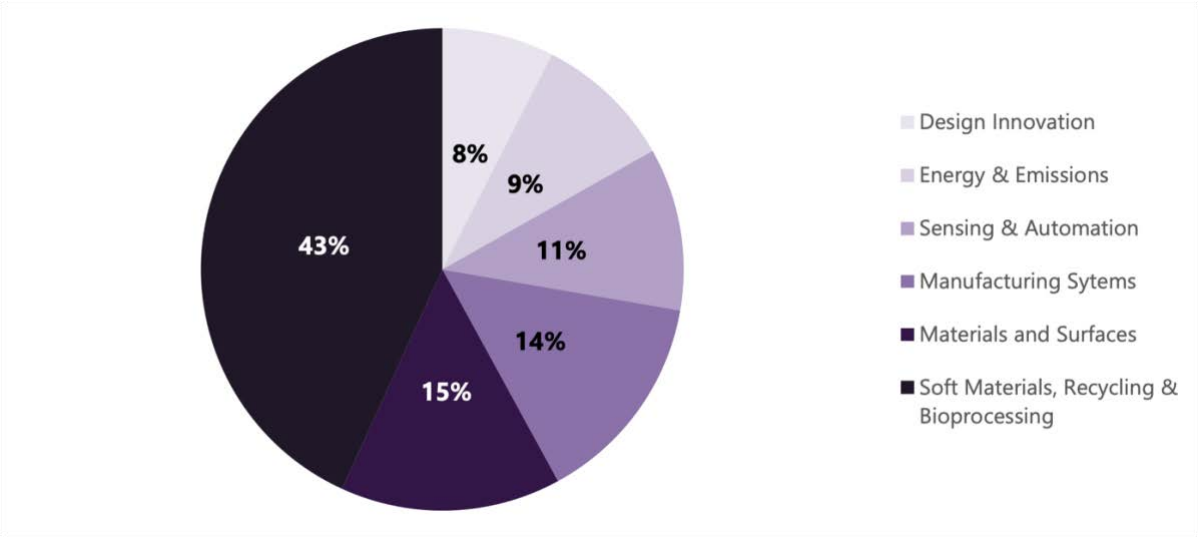
Number of university students directly supported through the NZPA projects (excludes those hired to work on projects as research assistants)	68	17

The median time for an the NZPA-facilitated research project to be completed is 5.6 months. However, some of the projects are much more complex and require a multi-year research investment. This is evident by the duration of the NZPA's currently active projects, with approximately 50% of its current research projects having been underway for more than two years.

Areas of focus

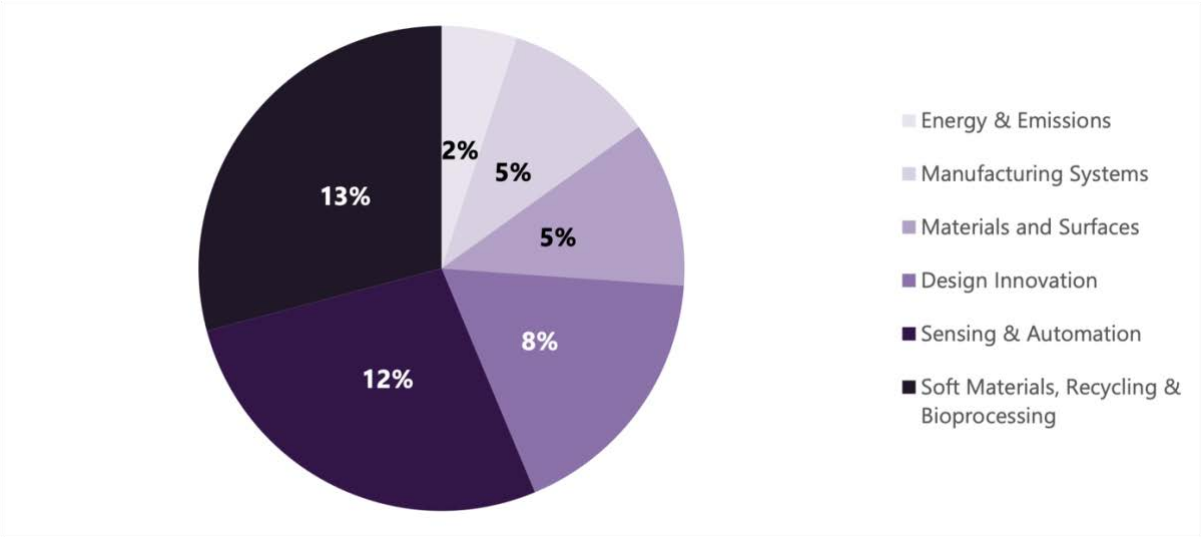
Figure 1 below shows that the NZPA's engagements with businesses are heavily focused on its soft materials, recycling and bioprocessing research portfolio (43% of engagements). This likely reflects that the NZPA has more research capacity in that portfolio – it is the only portfolio with two research leads (at the University of Auckland and the University of Otago) and is also the only portfolio where the research lead is at the University of Auckland, working alongside the core NZPA engagement team.

Figure 1: the NZPA engagements by research portfolio



An analysis of the completed NZPA projects shows projects are more evenly spread across three research portfolios. Figure 2 shows that 73% of the NZPA projects take place in the design innovation, sensing and automation, and soft materials, recycling and bioprocessing portfolios.

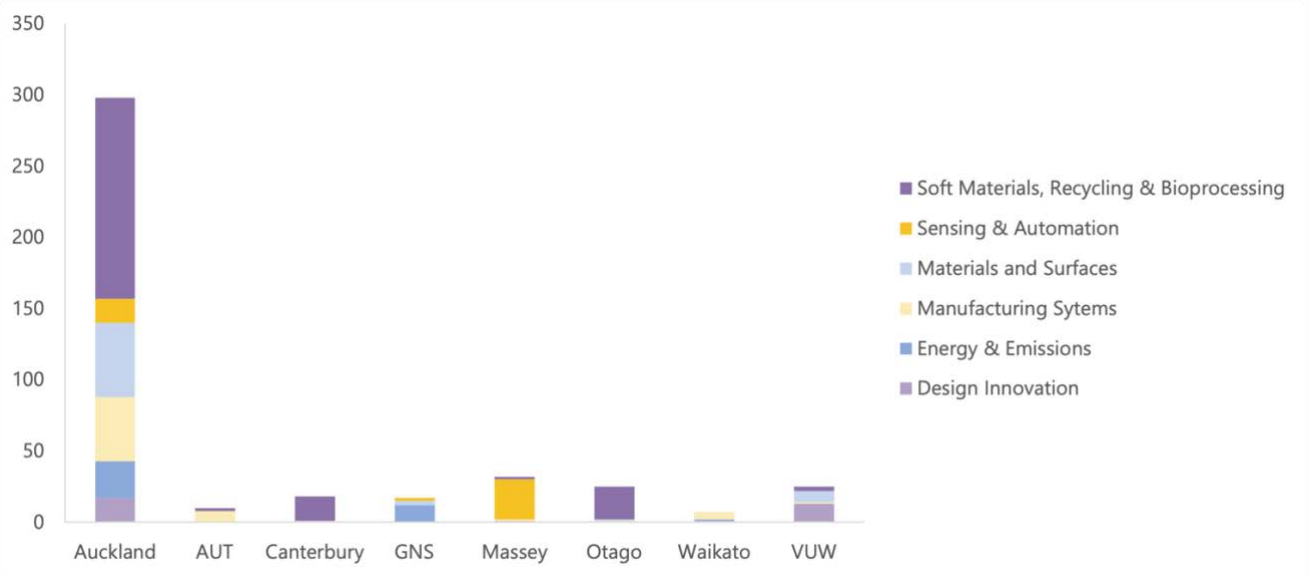
Figure 2: Completed the NZPA projects by research portfolio



Regional breakdown

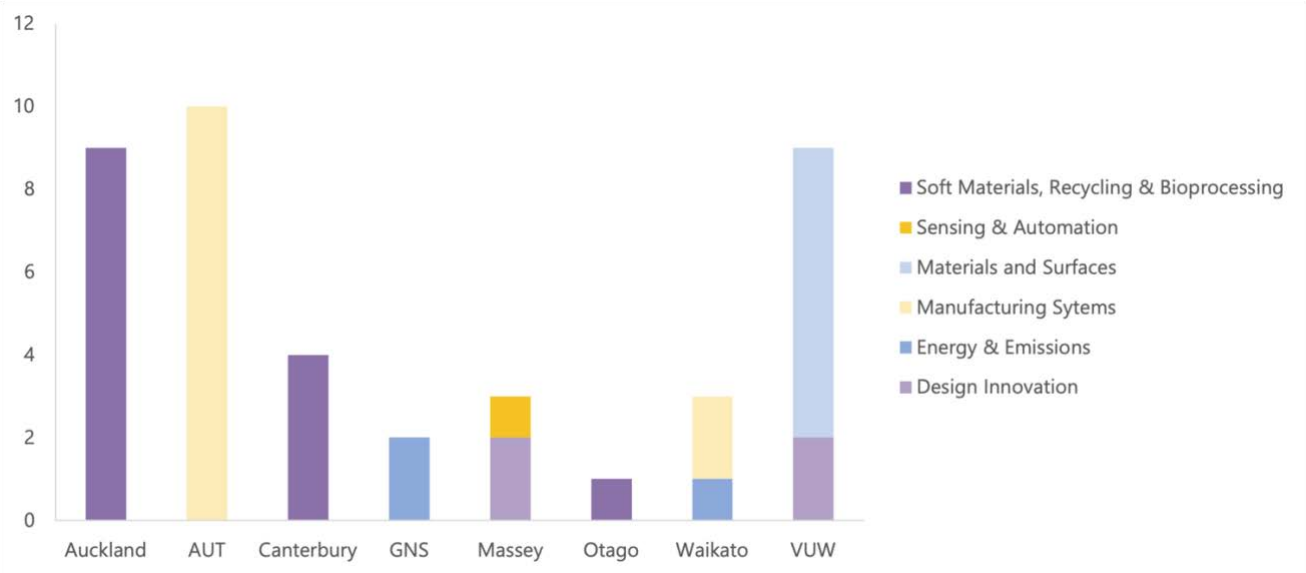
Figure 3 shows that 70% of engagements with businesses involve the NZPA team at the University of Auckland. This is to be expected given the operating model – the core the NZPA team is based at the University of Auckland and is funded to help scope and define research projects before researchers become too actively involved.

Figure 3: Currently active engagements by research institution and portfolio



Once a research project is initiated, the projects are spread around the country, depending on the relevant research expertise's location. Figure 4 below provides insight into the regional distribution of projects. The Auckland University of Technology has the largest number of active projects because it is the primary location for the NZPA's manufacturing systems research portfolio, and its proximity to the engagement team at Newmarket gives it access to the Project Lead capability.

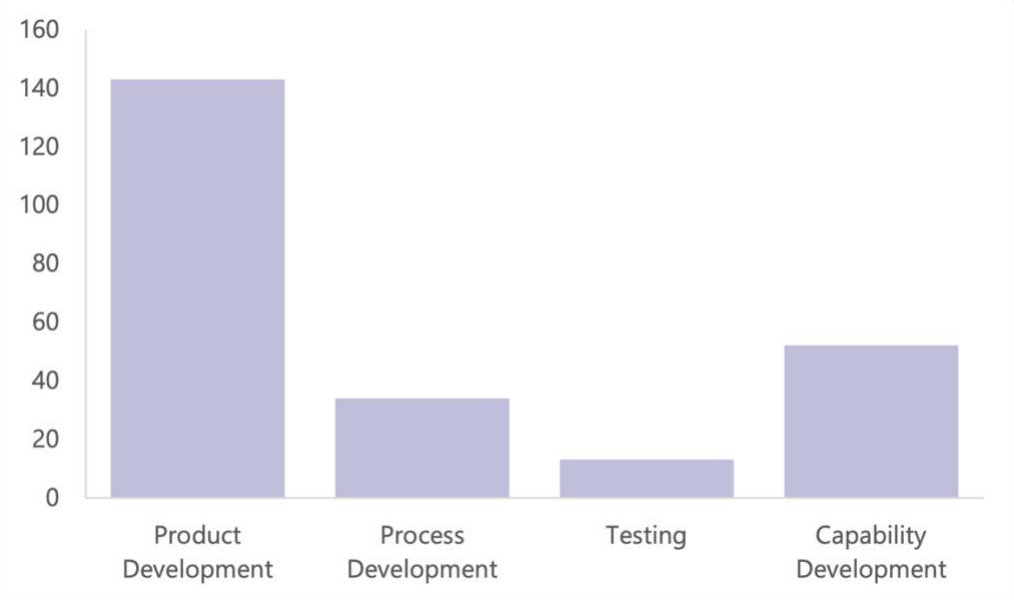
Figure 4: Currently active projects by research institution and portfolio



Nature of the projects

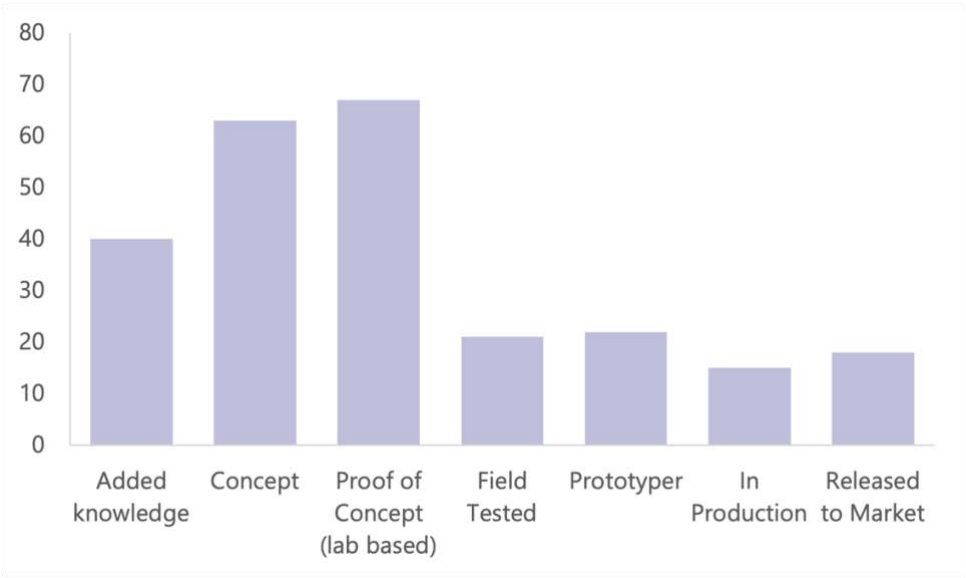
An analysis of the projects supported through the NZPA, as shown in Figure 5, shows most research projects were focused on product development (59% of projects), followed by developing business capability (22%), developing new processes (14%) and testing (5%).

Figure 5: Project focus



In terms of the traditional stages of developing a product or process, the NZPA's activities are clearly geared towards the 'seed' end of the spectrum – that is, its work often focuses on addressing manufacturing businesses' desire to explore new ideas, new concepts, and to provide lab-based proof-of-concept. Figure 6 demonstrates this below, showing the output of the NZPA's research.

Figure 6: Stage of development where the NZPA support targeted



1.2 The NZ Product Accelerator fills a gap in the ecosystem

Manufacturing businesses find it difficult to access New Zealand's research system

New Zealand's advanced manufacturing ecosystem is complex, and when manufacturing businesses are seeking support with R&D there aren't many well-established signposts to guide their search.

"I wouldn't know where to even start"

Previous government work noted that much of the publicly-funded research being undertaken has limited relevance or links to commercial outcomes for advanced manufacturing.

As our interviews progressed, it became apparent that scientists only recognised the value in industry-centred research when they had industry exposure. Otherwise, it was easy to let the research institution context dominate their perspectives.

Because academia is not built on industry-applicable foundations, there is no easy way for businesses to find the individuals that are motivated to solve industry problems. This difficulty navigating is compounded when business leaders have not had exposure to, and therefore do not understand, the workings of academia.

"We had no idea who was who in the zoo"

The NZ Product Accelerator offers a brokering role to address the business-science disconnect

The case for an intermediary role between businesses and scientists is supported by academic literature. Our research confirmed that the NZPA is playing this role in a way that is highly valued by manufacturing businesses. If the NZPA's impact was to be scaled up, **our findings suggest that they are well-equipped to fill this gap in the innovation ecosystem.**

One industry expert shared this:

"The NZPA is the best thing going in terms of bridging science and business"

The NZPA understand the needs businesses and research institutions have when attempting to collaborate. This crucial understanding has enabled them to effectively establish compatible partnerships. How they do this so effectively is unpacked in the following sections.

Academic literature supports the value of an intermediary role

Support for the NZPA's intermediary role is clearly stated in international academic literature. It stated that there are net benefits to broader society (that is, beyond a university and its client business) from translating new ideas into use faster and more efficiently.

Intermediaries filter, consolidate, store and communicate information to the right people at the right time. They contribute to the coordination capabilities of innovation systems by coupling complementary parties and re-orientating entities with different incentives and purposes. Their value comes not only from connecting organisations and individuals with specific interests, but from providing a common framework for communication, stimulating discussion, knowledge exchange and engagement. What an intermediary offers is specialised skill, an innate aptitude for idea translation and acquired contacts and know-how.

Academic literature also supported the case for an intermediary to be independent. The absence of an agenda when choosing an institution or researcher is best suited to address any particular research need. This property is a strong component of an intermediary and is evident in the NZPA.

A write-up of the case for public support of such intermediary roles is outlined in Appendix A.

The NZPA's function as an intermediary has parallels with similar initiatives overseas

Other intermediaries exist overseas that are similar to the NZPA. They focus on brokering in their respective innovation ecosystems. They aim to connect businesses with researchers for the wider economic benefit of the countries. However, a lot of these intermediaries also offer some form of grant or funding. We understand that this is outside the scope of the NZPA's role.

We examine four intermediaries that have similar roles to the NZPA:

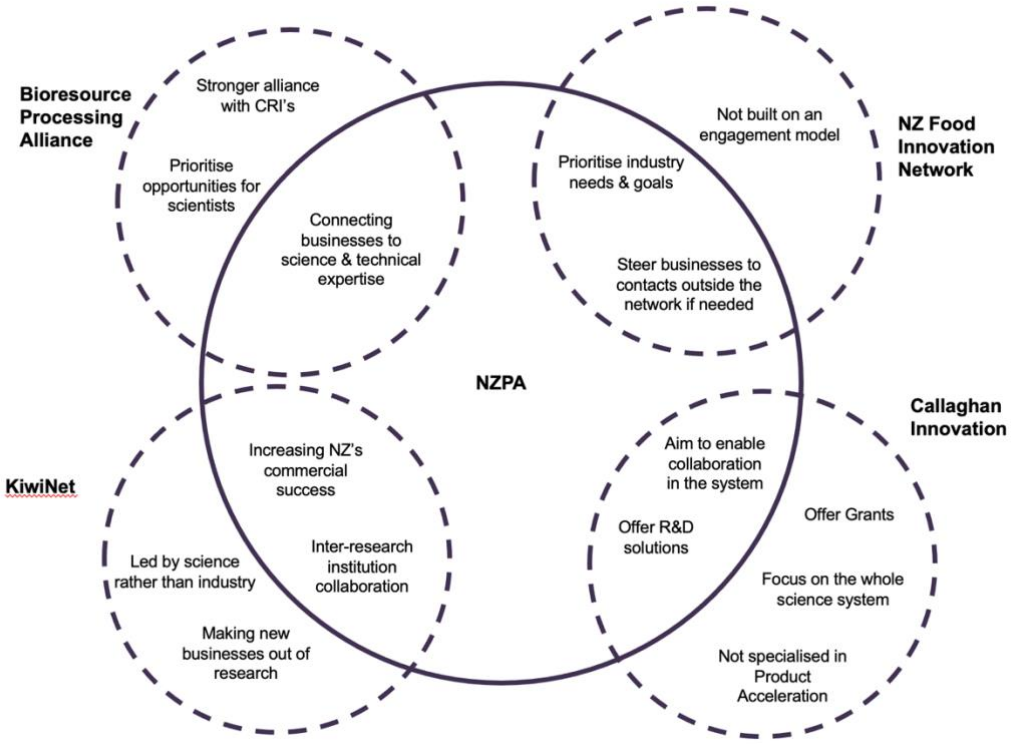
- Scotland's Interface is the most similar programme (in scale and structure) to the NZPA. Established in 2005, it aims to match businesses of all sizes with Scotland's academic expertise. Interface was funded 8.5 million pounds between 2005 and 2020. A portion of this funding is able to be allocated to innovators in the form of 'innovation vouchers'. An independent assessment of Interface found that it delivered realised benefits of £5.17 for every £1 invested, with this figure increasing to £18.11 when including expected benefits.[3]
- Canada's Mitacs was established in 1999. It is a not-for-profit that brings industry, academia, and government together in strategic partnerships. Mitacs was funded $708 million Canadian Dollars in 2021, with 88% of this figure going towards internships.

[3] The independent assessment can be found here.

- The United Kingdom's Catapult Network was established in 2008 following a review of the role of technology and innovation centres in the UK. The network fosters collaboration between industry, government, research organisations, and academia. It received 780 million pounds of funding for 2018 through to 2023.
- Australia's Innovation Connections Program paired businesses with an independent facilitator to guide projects, connected them with research institutions, and assisted them to apply for grants. It was funded under Australia's wider "Entrepreneur's Program" that had a budget of $480m AUD. However, the Innovations Connects Program was closed in May 2023. Its replacement, the "Industry Growth Program", is currently undergoing consultation.

Does anyone else fill this gap?

Through desktop research, literature review, and interviews, we identified four organisations as having the most overlap with the NZPA. None of these organisations are operating in the exact same space as the NZPA.



The New Zealand Food Innovation Network (NZFIN) is the most similar to the NZPA; we were convinced through our research that they are **also performing an intermediary role**, but exclusively for food manufacturers. The other key difference is the initial stages of their services tend towards risk-free access to technical equipment, rather than engagement-based approaches.

KiwiNet and the **Bioresource Processing Alliance (BPA)**, although seemingly similar, tend to work in the **opposite direction to the NZPA**; they find commercial or industrial opportunities for scientists, rather than finding scientific resources for industry.

The key point of difference between the NZPA and **Callaghan Innovation** is that Callaghan Innovation is the monitoring agency that manages the contracts for the NZPA, NZFIN and the BPA, among many other innovation products and services. Our research participants commonly described the NZPA's foundational engagement model as the key distinction between them and Callaghan Innovation. Although both offered R&D support, the NZPA is likely to be more open to whom they provide services to (often focusing on small-medium enterprises) and supports more technical research solutions (with Callaghan Innovation offering a full suite of services, including business support).

1.3 The NZ Product Accelerator's value proposition

The NZPA is not only meeting clear demand from businesses for R&D assistance, but it is doing so in a targeted and effective manner. Our review concludes that the NZPA is focusing on the right areas, is valued by business and research participants, and is working effectively. These characteristics are in large part due to its leadership, people, its ability to respond to businesses' needs in a responsive and collaborative way, and its culture of collaboration. Collaboration is key to success and will need to be carefully facilitated with any expansion.

Businesses access NZ's top minds and equipment

Our participants noted that the NZPA-facilitated connections with New Zealand's top academic minds and technical equipment, enable businesses to make technical breakthroughs in product development that **they would not be able to achieve on their own**.

"It's a no-brainer to access R&D through the NZPA"

Some businesses described that even when a research partnership was not a good fit, the initial engagement with the NZPA still had value as it allowed them to **think differently about a problem**.

According to our survey, clients largely accessed the NZPA for product development and testing. **Experiences were overwhelmingly positive**, with 84% of users agreeing, to some extent, that the NZPA added value to their business.

"The support we received from the NZPA far exceeded what we could have achieved partnering with a single Uni or CRI, because we had access to expertise from the entire country and with the NZPA's commitment to collaboration across its network rather than capture. I can't rave about this experience enough and I can't imagine any other institution coming close to providing the level of expertise and NZ-wide networking/introductions".

The near universal support for the work of the NZPA was also highlighted when we approached a Manufacturing Industry Association:

"We have a Chief Technology Officer group and they said [the NZPA] was the most useful thing the Govt has set up"

Industry-based opportunities for researchers

For academics that see a high level of value in industry-led projects, the business-to-academic partnerships that the NZPA facilitates, and the funding that it enables, provides them with access to industry projects **that they likely would not otherwise have access to**.

"Masters and doctorate students are the lifeblood of the NZPA. No other organisation is supporting students to work with businesses like this."

It is relatively common for PhD and Masters students to be funded through the NZPA. The NZPA supports around 17 students to work on projects per year. Businesses' investment often helps **cover study fees or provides a fixed-term employment** opportunity for the student at the company.

Speed of service

The differences in timeframes between universities and businesses were raised by the majority of our interviewees; the university teaching calendar does not suit market demands in the industry. More often than not, the university's timeline leads the project plan over commercial timelines. Although there is still room for improvement in this area, the NZPA staff understand the commercial realities businesses have to operate within and do their best to ensure projects proceed at a pace that works for businesses.

Intellectual property matters

Multiple businesses interviewed spoke of the crucial flexibility that the NZPA offers around intellectual property. Many research partners acting outside the NZPA fold will assume rights to the work they do creating difficulties for businesses trying to commercialise innovation. The fact that the NZPA facilitates IP agreements that work for businesses is a key point of difference.

Accessible costs that de-risk R&D

> *"Without the NZPA our start-up company would not exist. After formation the NZPA has continued to support us through R&D, access to resources and experts and making connections to the wider industry in areas where our collaboration with customers is useful. It's been instrumental in our success to date."*

Whether in-house or outsourced, R&D can often be cost prohibitive for NZ manufacturing businesses, particularly for SMEs and start-ups. The NZPA's business model significantly brings down the cost of R&D for businesses, de-risking this crucial activity that enables informed business decisions.

This finding was supported by the survey of users. 31 out of 95 respondents agreed that the "the engagement and research helped to lower the cost and barriers to R&D".

Partnering mindset

> *"This is a fantastic program. Massey Albany has research projects that we are very interested in that could substantially change the market we operate in. We would not have known about them without Product Accelerator."*

There is a sense of reciprocal power balances within the NZPA's partnerships. Businesses who have worked with the NZPA describe a relationship where the NZPA takes the time to really understand where they are coming from and ensure the partnership provides for their unique requirements. The sense that the NZPA is 'revenue agnostic', and therefore independent of who it works with, plays a large role in this.

Industry agnostic

The NZPA do not have ties to any industry in the way that other organisations who offer brokerage do e.g. The NZ Food Innovation Network have obvious biases towards research and commercial opportunities involving food. This independence helps to ensure they have a broad scope of connections to offer.

Our survey of the NZPA users proved this to be largely true. 40% of users stated that they were in the manufacturing industry, noting that manufacturing itself is broad. The remaining respondents were reasonably evenly distributed across the other Stats NZ ANSZIC industry classifications.

'Research Pull' vs 'Research Push'

The NZPA brokers research-pull partnerships where a commercial opportunity is identified first, then research is undertaken to make this commercial opportunity possible. This is crucial as it enables businesses' needs to stay in focus, and researchers to participate in true 'industry-based' projects.

Research institutions are traditionally more comfortable with research-push models so the NZPA providing advocacy here is important, and this is what sets the NZPA apart from organisations such as KiwiNet, who broker research-push partnerships.

We spoke to one business who came to the NZPA for the development of a special gasket required for a manufacturing machine. The NZPA was able to broker a partner to undergo this research for the business. This would not likely have happened under a research-push model, as academics do not tend to work on things quite so niche without first being directed there by a commercial opportunity.

Collaboration between universities

The current research, science and innovation system in New Zealand still largely operates in silos. A business approaching a university institution to request assistance would typically be referred internally through the institution's own ecosystem. There are limited ways to be referred externally to researchers with subject matter expertise at other institutions. Competition between universities for performance-based research funding can make it even more difficult for businesses to find help as this competition means they are less likely to be referred between universities

A key strength of the NZPA model is the collaborative nature of the research network. The network meets once a week for 90 minutes. The NZPA's core team will talk about businesses they have been engaging with, the researchers will talk about the work they are doing, and there is an open discussion about opportunities. The researchers are not protective of their research or their university's interests – they are first and foremost part of the NZPA at those meetings.

The NZPA's 'Secret Sauce'

Many of the strengths above do not so much describe what the NZPA do, but instead describe how they do it – the speed of operation, the accessible costs, the collaborative mindset etc. Our participants described how these crucial factors are what sets the NZPA apart from other R&D partners – this is the 'secret sauce' that gets businesses over the line and keeps them coming back.

It is important to recognise that many of the strengths found within this 'secret sauce' are not a result of formal structures within the NZPA, or a result of being a part of the University of Auckland. Instead, these strengths originate from the staff.

The strong influence of key staff members results in a risk that these the NZPA's 'secret sauce' may be lost from staff changes. **Whatever shape or scale the NZPA takes in the future, it is crucial that their 'secret sauce' is not diluted or lost.** We have spoken to how this risk could be mitigated in our future-state options.

1.4 The outcomes from the NZ Product Accelerator

The NZPA has been able to achieve three important outcomes effectively: businesses are making new research connections they could not make without the NZPA, researchers are focusing on new areas with commercial applications, and the NZPA is building up a base level of knowledge and contacts to help identify new opportunities.

Our conclusions reflect the collective experience of ThinkPlace and Sapere analysts in evaluating and reviewing government programmes and are informed by our interviews with clients and surveys of both user and non-user groups.

The NZ Product Accelerator is having an observable impact in three areas:

1. Businesses are making new research connections that otherwise would not occur

Barriers to growth in the advanced manufacturing sector had previously been set out; particularly the difficulties investing in R&D and accessing the technical knowledge businesses require to grow. Our own survey of 'non-users' of the NZPA showed that **[70%] of firms who were unaware of the NZPA faced challenges in developing new products or using new technologies.**

The NZPA's primary impact is that businesses are being connected to researchers with subject matter expertise in the fields they required – and these connections would not take place without the NZPA.

However, the NZPA is more than a 'front door' for accessing research institutions and facilitating business-to-researcher connections. It is effectively an 'on-ramp' for manufacturing businesses looking to undertake R&D. Public funding improves the prospect of successful research collaboration by:

- providing businesses with front-end support to enable the research team to understand their context and to define their needs and commitments, and
- funding on-call capacity from researchers around the country to engage in 'free' project scoping and 'kicking the tyre' conversations with businesses. These initial conversations do not require financial contributions from businesses, which we heard was important in R&D where the prospect of research dead-ends means some businesses are unwilling to fund external researchers.

Our survey of the NZPA's clients confirmed the additionality being provided by the NZPA's services. 67% of client businesses stated the Product Accelerator had saved them time/costs by facilitating

connections with researchers – with 61% stating they did not believe they could have made those connections by themselves.

The following quotes reflect perspectives we heard repeatedly through our engagements – the NZPA is making business-researcher connections that would otherwise be unlikely to occur:

> *"As a startup developing a new product, the support we received from the NZPA far exceeded what we could have achieved partnering with a single Uni or CRI, because we had access to expertise from the entire country and with the NZPA's commitment to collaboration across its network rather than capture."*

> *"I can't rave about this experience enough and I can't imagine any other institution coming close to providing the level of expertise (e.g. specific science paper recommendations and technical suggestions) and NZ-wide networking/introductions. The atmosphere and mission of the NZPA are clearly distinct, in my view, and new product developers such as myself will benefit immensely from expanding the NZPA's capacity while maintaining its unique value-adds."*

Our conclusion is that large business are more likely to have the resources and capability to navigate New Zealand's science ecosystem. Larger businesses can incur the time and costs required to find out who to talk to, can invest in having dedicated personnel to scope and manage R&D projects, and research institutions are more likely to be receptive to their approaches (with the prospect of a formal and sometimes lucrative partnership eventuating).

However, our interviews confirmed that start-ups and SMEs face significant hurdles finding applied research expertise in particular. These firms often do not know what support they need (they may have a pressing commercial problem), do not know how to find a researcher with an applied research mindset, and many are also dissuaded from engaging out of concern about having to relinquish their intellectual property. Some firms commented they had previously put lines of enquiry on hold due to not being able to find researchers with the right skills. It is these smaller businesses where the NZPA is clearly having a demonstrable effect on supporting R&D.

Over 50% of businesses state they were start-ups when they first accessed the NZPA's services, and 60% of businesses accessing the NZPA had never received any form of business assistance or grant from a government agency. These survey results confirm our view that many of these manufacturing businesses are relatively small, less likely to be on the radar of other agencies, and are likely struggling to access the R&D support they need to grow their businesses.

2. Researchers are now focusing on new areas with commercial applications

The long-term impact of re-orienting academic researchers to applied commercial research should not be overlooked. Indeed, it is likely to be one of the most enduring impacts that the NZPA will have.

Many university academics remain internally focused or pursue lines of enquiry that are focused on generating research grants or peer-reviewed publication.

While on a small scale, the NZPA model has clearly changed the behaviour of the researchers that are part of the NZPA network. Through their work, these researchers have established and extended their

own business networks and are undertaking research they otherwise would have been unlikely to focus on. They are now increasingly focused on research with commercial applications in their day-to-day work – beyond the NZPA-funded projects that they work on.

Several university researchers noted that the NZPA has given them a permission structure to engage with businesses regularly and to dedicate time each week to having those informal conversations that can then spin out into larger projects. Several researchers observed that their careers had changed course due to their the NZPA-facilitated connections, with many being pushed into new lines of work and enquiry.

One NZPA researcher we spoke to had just formed his fifth start-up company. His personal engagement with industry only began after he joined the NZPA network and he fully credited the NZPA for the opportunities he had taken, noting that being part of the NZPA network had transformed his entire career to be externally focused on commercial opportunities. Another researcher, who had just formed his third spin-out company, commented that the NZPA provides a wonderful model for business-researcher collaboration. He was adamant that if the NZPA was to vanish overnight, it would be a massive step backwards for manufacturing businesses as well as researchers – he would have to pivot back to writing grant proposals rather than focusing on commercial opportunities.

An average of 17 students receive funding through the NZPA each year to work on projects (with more receiving support in research assistant roles on commercially funded projects). Tracking the careers of these students would make a fascinating case study, but by all accounts, many of them are now moving into careers with a strong practical and commercial focus – either as researchers themselves or in industry. Following the completion of their qualifications, some students take up full-time positions with businesses they had connected with through the NZPA, or start-up companies that had been established through the NZPA work.

Finally, we observe that the NZPA is not crowding out any other activity. It is operating in a space that universities have been unwilling to move to – a mix of 'research-pull' ideas, research that is often at the concept-stage, typically working with smaller businesses, and using students to provide low-cost access to applied research. The institutions we spoke to confirmed that they typically have "longer term horizons and bigger horizons" than the projects and clients that the NZPA is focusing on.

3. The ongoing 'network effect' is leading to new opportunities

The third impact we observed is that the NZPA is not solely reacting to approaches from businesses; over the past 14 years it has built up a considerable base level of knowledge and its research network is now identifying and responding to new opportunities. It is primarily doing this by linking researchers together and connecting businesses with other businesses with similar interests.

On a small scale this is occurring organically as the team identifies overlapping research or commercial interests and appears to be well received. We spoke to several businesses about the business-to-business connections that had resulted from their the NZPA engagement and all welcomed the role the NZPA played in supporting those conversations.

On a larger scale the NZPA is endeavouring to be strategic about where could make the biggest difference through a focused application of its resources. It labels this work as its Tomorrow's

Economy workstream. This workstream is currently a small adjunct to its main activities. We explore this concept and potential options for expansion in the following chapter.

Our survey of the NZPA's clients confirmed the more proactive role they are playing in identifying possible opportunities:

- 20% of the NZPA's clients used the service after being approached by the NZPA
- 26% of the NZPA's clients stated that the NZPA staff had helped them to make important connections to other businesses.

1.5 Quantifying the value generated by the NZ Product Accelerator

We are confident that the NZPA is having a material impact on the performance of advanced manufacturing businesses in New Zealand and that the spillover benefits from its activities far exceed the $2.06 million spent annually on the programme.

It is challenging to quantify the exact value that the NZPA generates, in part due to the uncertainty as to what would occur under a counterfactual of there being no NZPA. Such an assessment would require a more extensive study that compares the financial performance of the NZPA clients with a similar group of non-client businesses. The estimates below are inherently uncertain due to reliance on participants' self-assessments of the value attributable to the NZPA.

Businesses confirm the Product Accelerator has had a material impact on their operations

The value derived from those using the NZPA-facilitated research connections were identified by survey participants as including:

- identifying new research opportunities (52%)
- developing new products or processes (47%)
- identifying new commercial opportunities (41%)
- lowering the cost and barriers to R&D (31%)
- saving costs by ruling out unviable ideas they may have otherwise pursued (16%)

We have outlined below three approaches to quantifying the potential value generated by the NZPA to manufacturing businesses in New Zealand. We note that the following approaches focus on projects, that is, not including the value from the NZPA's engagements for which we have anecdotal evidence of.

Quantifying value (scenario 1): clients' self-assessments to the NZPA of the potential value of their NZPA-supported products ($150 million p.a.)

the NZPA endeavours to measure the potential impact of its activities by asking clients to estimate their 'potential value of product' when undertaking a research project. The estimates are necessarily speculative and reflect a scenario where the business estimates the aggregate revenue that could be generated for their business if the project being scoped resulted in a successful commercial outcome.

In the 4 years to June 2023, 42% of the NZPA's clients who commercially funded a research project were able to provide the NZPA with an estimate of the potential revenue that could be realised from the project – totalling $984 million (an annual average of $246 million). Even under some conservative assumptions, this figure indicates that the NZPA generates significant incremental value:

- We have assumed the 58% of projects who could not estimate the potential value of their product generated no value from their interactions with the NZPA (this is unlikely to hold true, but is designed to ensure the value calculations are not over-estimated).

- We then assumed that some of this commercial value would have been generated anyway, even if the NZPA did not exist. Our survey indicates 61% of the NZPA's clients were confident they would not have made the research connections they did without the NZPA.
- Applying both those discounts means that $150 million in potential aggregate revenues could be generated from each year's research projects due to the role played by the NZPA. This equates to a potential per-project value of $2.8 million ($150 million divided by the 53 research projects initiated each year). This figure also does not include the value of the NZPA's engagements, for which we have heard anecdotal evidence of commercial benefit.

Quantifying value (scenario 2): extrapolating aggregate value from survey results on the value businesses placed on the NZPA's activities ($36.9 million p.a.)

Another input into assessing the potential value of the NZPA came from our survey of the NZPA's clients, who we asked to quantify the value that the NZPA generated for their business. Our survey was completed by 120 respondents; 23 of whom provided a dollar estimate of the value that the NZPA was likely to generate for their business (totalling $54.7 million).

We can use these estimates to extrapolate a potential value from the NZPA:

- We assumed this value was generated by projects initiated over a 4-year period.
- As above, we assumed only 61% of the value is attributable to the NZPA (that 39% of the value would have been achieved if there was no NZPA) (value of $33.4 million over 4 years.)
- The survey captured views from 48 projects that proceeded to a commercial fee-for-service research project. If we conservatively estimate those respondents who did not provide a dollar estimate of value (25/48) derived zero benefit from the NZPA's support, this would equate to per-project value of $700,000 (this is another assumption that will understate the value of the NZPA, particularly as many respondents indicated they found it too challenging to estimate the value they received, not that they received no value).
- As the NZPA initiates 53 projects per year, extrapolating the survey results would mean that $36.9 million in potential aggregate revenues could be generated from each year's research projects due to the role played by the NZPA.

Quantifying value (scenario 3): extrapolating using *median* estimates of value from survey results on the value businesses placed on the NZPA's activities ($6.6 million p.a.)

To quantify a lower-bound of the value generated by the NZPA we used the *median* estimate of value from the survey results, assumed projects that did not provide a dollar estimate of value generated no commercial value from their engagement with the NZPA, and assumed 39% of the value would occur if the NZPA did not exist.

Our estimate of the potential value of the NZPA under this scenario is:

- The median estimate of value provided by the 23 survey respondents was $125,000.

- As the NZPA actually initiates 53 projects per year, extrapolating the survey results would mean that $6.6 million in potential aggregate revenues could be generated from each year's research projects due to the role played by the NZPA.

This series of assumptions generates an artificially low estimate of the value of the NZPA by effectively discounting the substantial commercial value that could be generated by a handful of highly successful projects. It also disregards the value generated by firms that found it too difficult to assign a dollar value, and the value generated from the NZPA engagements that did not proceed to a project.

Our conclusion on direct value to businesses from the NZPA

The three scenarios outlined above provide estimates of the annual value generated for businesses by the NZPA of $6.6 million, $36.9 million and $150 million. The assumptions we have used to generate these estimates are very restrictive and ignore the very real potential that a small number of successful projects could generate considerable commercial value. Our best estimate is the NZPA generates at least $6.6 million in additional value for participating businesses each year, with the highly credible range being much higher.

The activities supported by the NZ Product Accelerator will be having broader spillover benefits

The manufacturing sector in New Zealand is essential to the success of other key sectors and the performance of the New Zealand economy – it provides more than half of the value of New Zealand's exports and is a major source of foreign direct investment. Growth in the sector has ripple effects beyond the private benefits accruing to supported businesses.

Depending on the subsector, one dollar of additional output in manufacturing industries produces between $2.06 and $3.12 in broader economic activity.[4] Applying this multiplier range provides an insight into the potential broader economic impact of the NZPA:

	Total annual economic impact
Scenario 1 (value of the NZPA products; the NZPA data):	$309m - $468m
Scenario 2 (aggregate value of the NZPA activity; survey):	$76m - $115m
Scenario 3 (median value of the NZPA activity; survey):	$14m - $21m

Similarly, we can examine overseas studies on the expected benefits of innovation brokers. A study on Scotland's Interface programme, referenced in section 1.2, provides value for money multipliers that

[4] Butcher Partners multipliers. MartinJenkins 'Manufacturing Matters: Final Report' (28 February 2020).

show the economic impact of investment in the programme. [5] Applying the benefits multipliers to the annual cost of the NZPA results in annualised realised benefits ranging from $10.7m (realised benefits only) to $37m (realised and expected benefits).

The above analysis indicates that the $2.1m of expenditure made on the NZPA programme each year is highly likely to be generating wider economic benefits that far exceed the level of public investment.

The Government is getting a financial return on its investment

We were also requested to undertake a breakeven analysis on what impact the NZPA would need to have on participating businesses for the government to receive a financial return on its expenditure through higher tax revenues (i.e. ignoring the value generated for private benefits as well as the broader economic spillover effects). Our analysis is outlined in Appendix C.

The results of this analysis show that from a financial perspective the government would get a return on its investment if the NZPA's activities generated at least $23.4 million of new annual incremental revenue for participating businesses. Our observation is that this incremental revenue breakeven point appears relatively small compared to the NZPA's outputs – and that is without considering the wider spillover benefits associated with supporting the advanced manufacturing sector.

[5] The independent assessment can be found here.

1.6 Case studies

"We've made $40-50 million out of one product thanks to the NZPA's testing"

In its sixth year of engagements with the NZPA, this company has achieved the rare feat of being able to estimate some monetary value of the NZPA's assistance.

The Product Manager relies almost solely on the NZPA to replicate their testing of new innovative products. For example, they once engaged an NZPA research team to carry out extensive heat testing of a new product idea, and due to the validated findings from the project they were able to confidently release the product to market. The product has been extremely successful, bringing in up to $50 million from sales.

The NZPA is their 'go-to' due to the ease at which the engagements take place, the reliability of the research quality, and the lengths the network goes to accommodate for the company's needs.

"The NZPA's researchers tend to stick to the brief- something I haven't found with other researchers. And I love how enthusiastic the team are to be involved."

There have been countless projects between this company and the NZPA over the past six years, and even when the initial engagements didn't convert into a project, the conversations led them to different types of thinking that they wouldn't have explored otherwise. The Product Manager also feels that the NZPA's advice and brainstorming sessions during the engagement stage, as well as thorough technical testing, have saved them from many mistakes. Although it would be impossible to quantify, they know these mitigated mistakes have therefore have saved them significant time and money.

"The NZPA has taught us that finding what you don't want to do is just as important as finding what you do want to try."

A new company because of the NZPA

The NZPA's support for early-stage research led to the establishment of an entirely new company.

An NZPA lead researcher for Materials and Surfaces began working with a manufacturer of polyurethane to explore the feasibility of applying antimicrobial coatings to polymers. Alongside commercial funding from this manufacturer, support from the NZPA enabled initial scoping discussions to take place and for a stipend to be paid to a student working on the research as part of his PhD research programme.

The research was successful and a new company was formed in 2016 to commercialise the technology. The technology applies chemistry to bind silver entities to a wide range of polymer-based

coating materials, which has proven to provide a highly effective antimicrobial and antiviral coating. Potential applications include paint and coatings, food processing, healthcare and medical devices, flooring, textiles, furniture and upholstery, and transport areas.

Owners of the new company included the original polyurethane manufacturer, the lead researcher, the researcher's university, and the student researcher, who became the founding CEO of the new company. The new company has recently completed its second capital raise. It has been granted patents in the US, Singapore, Australia, South Africa and India.

NZPA support to develop a new product

The NZPA was approached by a company who was having difficulties with pylons it was sourcing from China, which became brittle over time due to UV exposure (due to the use of the pylons there were limitations on the products that could be used in the pylons' construction). The company had an opportunity to supply 10,000 pylons overseas and needed the problem fixed quickly.

The researcher was asked whether it was possible to introduce a UV-stabiliser, but they instead recommended replacing the material with a rubber-based product. Within three months the researcher had solved the problem and had introduced the business to new manufacturers. This new product has opened up new markets for the business. The company has since come back to the researcher to develop new products based on similar concepts.

Chapter 2

Future State

2.1 Key challenges for the future

While the NZPA is offering an important and valued service, we have identified some pressing policy issues that need to be considered before options for the future of the NZPA are examined in the following sections.

We have grouped these policy issues into three broad categories:

- **Funding constraints (Section 2.1.1)**
- **The business model (Section 2.1.2)**
- **A question of focus: Tomorrow's Economy (Section 2.1.3)**

2.1.1 Funding constraints

The key challenge facing the NZPA is the funding constraint it is operating under. Without additional funding, the NZPA is unlikely to have a viable model beyond the next 18 months once the overheads fee through the University of Auckland increases.

However, the NZPA is also currently operating at capacity. It is constrained in its ability to raise awareness among potential users, and it is unable to add new researchers or institutions to the network to address gaps in expertise or demands from businesses.

Treatment of overheads

New Zealand universities operate under a fully-costed funding model in which an agreed formula determines each institution's overhead rate. This rate is then applied to all FTE on government-funded contracts. Each year, the University of Auckland has requested that the NZPA's funding from MBIE be fully-costed; when this has not materialised, the University of Auckland has offered 'overheads relief' which, essentially, amounts to co-funding from the University. The NZPA stressed its gratitude for this and attributed it to the positive and ever-strengthening relationship it has had with Auckland Uni-Services in recent years.

"The University of Auckland has come to the table and provided relief for over 5 years and we recognise and are grateful for that."

- *Mark Jones (NZPA)*

The University of Auckland plans to align the NZPA with the rest of their externally-funded programs from January 2025 by applying the full 115% overheads levy on the funding for the University of Auckland staff, which includes the core NZPA leadership team and associated University of Auckland researchers. Based on current funding arrangements, this means that the NZPA's annual overheads payments will increase from $328,000 to $812,000. This is nearly 40% of the NZPA's current budget.

Impact of an increase in overheads

The University of Auckland staff indicated, and the NZPA leaders concurred, that the current arrangements permitted the NZPA to effectively provide businesses with subsidised access to researchers, students and materials that other academics (who have to recoup the full overheads rate) could not compete with. Businesses frequently mentioned their appreciation for this subsidised researcher access:

"The NZPA significantly reduces our risk profile. We can have engagements with researchers that go nowhere tangible but still benefit our thinking in some way, saving us a lot of guesswork and costing us nothing in the process. Our industry is too high-risk for guesswork."

As we outline in our options analysis in the following chapter, **the NZPA will have to cut back its current operations by approximately 30%** to find the cost-savings necessary to pass on to the

University of Auckland. In our view, **it is unlikely the NZPA will have a viable value proposition** at this reduced size.

The NZPA has a 'funding squeeze' that limits what it can deliver

The NZPA is constrained by its current level of funding. This constraint is especially obvious in face of what appears to be some significant opportunities to support the growth of advanced manufacturing.

A real budget decrease is making researchers engage less with the network

In nominal terms the total funding spent by the government on the NZPA has remained unchanged since 2013 at ~$2.06m p.a. The lack of any inflation adjustment over the past decade means that the NZPA staff and research leads have to commit less time each year to the NZPA to remain within budget.

Furthermore, the NZPA's shift to baseline funding in 2019 meant that the NZPA's funding actually declined, with Callaghan Innovation now retaining approximately $35,000 to manage the contract and relationship. This deduction, combined with the effects of inflation, mean that the NZPA has experienced **a real budget decrease of 25%** from 2013 to 2022.

Our conversations indicated that a consequence of this funding squeeze was that research leads were cutting back operational spending that they would otherwise spend to 'kick the tyres' on potential projects – materials, access to equipment and research assistant time.

There are gaps in research expertise that could be filled with more funding

The research network's current areas of expertise are restricted to what can be delivered with existing levels of funding.

If the NZPA receives a request from a business it will look to put them in touch with the most appropriate researcher, even if that researcher is outside of the network (if they are aware of them). However, a non-network (unfunded) research member is unlikely to have the same time commitment to have these important scoping conversations with businesses. Non-network members will often require the business to go through the University's contractual processes to set up a fee-for-service arrangement from the beginning of the engagement – which can be off-putting for many smaller businesses.

The NZPA has identified some priority subject-matter areas where on the basis of observed demand from businesses. It would look to expand its offering into these areas if additional funding was available:

- Food and beverage – advanced manufacturing systems, innovation in sensing and robotic planting/harvesting, and sustainability/circularity of processes where waste is currently created (packaging, homes, refrigeration etc)
- Animal and plant research – ranging from new protein sources, carbon emissions, pollution/water quality etc. to aquaculture and aquaponics, right through to bioforestry and biotransformation generally (e.g. Hemp)
- Digitisation of industry – especially construction and infrastructure where trends towards digital twinning can be further advanced to reduce timeframes and cost, as well as AI-driven reports for condition surveillance and routine maintenance.

The current budget does not allow for succession planning

As noted above, the NZPA has been successful, in part, due to it retaining the core team of individuals who set up the network approximately 13 years ago. We heard from several sources about the effectiveness and value provided to businesses by these key individuals.

While these key individuals are a significant strength of the NZPA, they also represent a significant risk to the future viability of the NZPA model. The NZPA operates on a tight budget that does not allow for succession planning. **Ideally, the NZPA would be funded at a level where it could invest in identifying, hiring, and training individuals with similar skillsets.** By doing so, they would ensure the NZPA's viability in the longer term. At present, the magnitude of funding is not sufficient to enable this investment.

With additional funding, the NZPA could address unmet demand

At present, the NZPA engages with approximately 100 businesses a year, which results in around 50 research projects taking place between businesses and partner institutions. This represents the capacity of the network at current funding levels.

Our interviews and workshops with the NZPA team confirmed that their primary constraint at present is funding – not a lack of demand. The NZPA staff are conscious that awareness of what they do is relatively low in the manufacturing sector, but they simply do not have the funding to do large-scale outreach, nor the funding to be able to respond if more businesses needed assistance.

Unmet demand from businesses

Our evidence of unmet demand from businesses is anecdotal only, but indicates there are likely to be opportunities to increase awareness and to expand the NZPA's services to additional firms.

We asked several manufacturing industry associations to circulate a survey on our behalf to their members to test awareness levels and the level of interest in the services offered by the NZPA. We received 31 responses. The surveyed population group represented a group of engaged

manufacturing companies, many likely in high-growth markets, with 92% having received some form of business assistance advice or grants from government agencies.

The key findings from that survey include (full survey results are available in Appendix B):

- Only 39% of firms were aware of the NZPA
    - Of those 33% had accessed the NZPA's services
- Of the 61% of firms who had not heard of the NZPA:
    - 66% faced R&D challenges developing new products or using new technologies. Key R&D challenges that were identified included the resources needed to invest in R&D (time, money, and specialised requirements).
    - Once the NZPA's offering was explained, 80% of respondents said they could foresee a scenario where they might use the NZPA in the next five years

The survey is not representative, however it does provide insight into the potential to extend the reach of the NZPA's services into the advanced manufacturing sector. Within this group of highly engaged manufacturing firms, 49% were unaware of the NZPA but could envisage a scenario where they could make use of its services.

If we assess the potential pool of demand from the manufacturing sector only then it is certainly credible to believe that, with additional funding, the NZPA could scale its activities beyond the 100 business engagements and 50 projects that are undertaken each year.

- The manufacturing sector includes approximately 22,000 firms.[6] The NZPA has a total client base of approximately 500 businesses, which means it has had contact with no more than 2% of manufacturing businesses in the country.

- If we narrow the potential pool of future demand to only those in the manufacturing sector with at least one employee (i.e. excluding start-ups) and fewer than 50 (the technical definition of a SME, which is where the NZPA assesses it can add the greatest value), there are 10,659 such firms in New Zealand. Under this scenario the NZPA's client base represents only 5% of the 'market'.

- We can apply stricter restrictions to this group, including:

    - If we can assume 50% of that narrower population group may have no interest in ever seeking external assistance for R&D then the potential market would be 5,330 (the NZPA having 9% of the market)

    - If we apply our survey results then potentially 61% of that population group is unlikely to have heard of the NZPA, but 80% would potentially use the NZPA if they were aware of its services. This would equate to a potential demand pool of 2,600 manufacturing firms and mean that the NZPA client base represents only 19% of the potential 'market'.

[6] Statistics New Zealand 'New Zealand business demography statistics: At February 2022' https://www.stats.govt.nz/information-releases/new-zealand-business-demography-statistics-at-february-2022/

This thought exercise is indicative only – and in reality the NZPA's client base extends well beyond the manufacturing sector. However, it does convey that the NZPA has potentially only scratched the surface of the demand that exists for a brokering role in advanced manufacturing.

Unmet demand from researchers

Our interviews with research leads confirmed that there would be significant demand from within their institutions to join the NZPA network and to support a scaled up version of the NZPA.

One research lead who has been with the NZPA since 2009 commented that there was sufficient demand at his university to justify a 4-5x increase in operating budget. Others observed that any additional funding could make a significant impact by enabling much greater support of student research, as well as adding additional areas of expertise.

Our interviews left us in no doubt – if the government was minded to increase funding for the NZPA network, then there would be little difficulty in scaling the research network to deal with any increase in demand from businesses.

2.1.2 The business model

The current model imposes limits on performance…

The current NZPA model is run out of the University of Auckland. It is a somewhat uncomfortable fit for a national network with a heavy focus on business engagement and commercialisation. It comes with several key costs and risks:

1. **Overheads**: as noted above, the current model means The University of Auckland will levy an overheads charge on the core non-research NZPA team that administers the network and focuses on business outreach, engagement, and project management. This imposes an additional cost of approximately $600,000 per annum that would not be faced if the NZPA was a legal entity outside of the University environment. However, we note that other operating expenses would be incurred e.g. rent.

2. **Staffing constraints**: the University of Auckland uses the funding to cover the costs of its employees, meaning the management team of the NZPA effectively has very limited control over staffing. While this has not created any issues to date (indeed the value of the NZPA lies with the passionate individuals involved), it is not difficult to foresee a scenario where this could create issues in the future, should key individuals retire. While there are not contractual restraints on the University of Auckland hiring outside contractors to fulfil roles at the NZPA, we understand such staff would be considered "professional staff", meaning they would be unable to act as principal investigators (i.e. to act as director for the NZPA) or to take roles that academic staff can fulfil. This means the NZPA is limited in being able to hire external staff with necessary business skills under the current model.

3. **Dependent on alignment with the University of Auckland's interests**: the NZPA model works at present because it is welcomed by the University of Auckland and it is not seen as threatening by the University's commercial arm (either in terms of size or areas of focus). However, this could change. The NZPA is a unique model whereby the University of Auckland staff, through the NZPA, are referring commercial opportunities to the most capable researcher in the country – which as the evidence demonstrates, will more often be at other universities. There is a risk, however small, that over time the interests of the University of Auckland University and the NZPA will diverge, particularly if the NZPA's role significantly increases in size or scope, or if there is a perception that it is cannibalising potential revenue for the University of Auckland's Services.

… but the case for change remains uncertain

While the model imposes some quite significant limitations, there is also value in the NZPA being embedded within a University ecosystem. Having the NZPA within the University means it has instant credibility when engaging both businesses, researchers and other institutions (including those from overseas). Staff also have an inherent understanding of how research projects evolve, and they have a foot in the door in accessing networks. Furthermore any change to establish the NZPA as a standalone

legal entity would be highly disruptive – and would require key staff to leave their jobs at the University of Auckland to move to any new entity.

The current arrangements may not be ideal, but they are working. There are inefficiencies and risks with the structure, but these are unlikely to have too profound of an impact on the NZPA's ability to remain operating, given the small levels of funding currently involved ($2m), and even if funding were increased.

Our view is that the optimal long-term model for the NZPA is likely to be as a standalone entity that is closely integrated with Universities; however, such a change is likely to come with some significant risks and costs and needs to be explored more fully. Given these uncertainties, we are not recommending any change to the current model.

We are instead recommending that both the NZPA and Callaghan Innovation work together on a **business case** that explores setting up the NZPA as a new legal entity outside of the University of Auckland. This should be completed well in advance of January 2025, which is when the NZPA's overheads are set to increase.

2.1.3 A question of focus: Tomorrow's Economy

"If we only focus on research that needs to be done, then we ignore research that has already been done. We can identify products that need accelerating." – NZPA Advisory Board member

The NZPA's core offering is to provide an intermediary role, supporting businesses to connect with the skilled researchers they need to help unlock commercial opportunities. Conceptually this can be undertaken as a series of discrete steps – each engagement is specific to the business as the intermediary reacts to the needs of the business and helps to scope its research needs.

The core NZPA team (and much of the research network) has been fulfilling this brokering function for 14 years. During this time, they have developed a sense of the areas where researchers are at the cutting edge in their fields and where groups of businesses are interested in pursuing new lines of commercial opportunity.

Our challenge as part of this review was to assess the appropriate role for the NZPA

Should it be reacting to discrete opportunities to support businesses solve the problems they are needing help with, or should it also have a mandate to be more proactive to leverage its knowledge base to endeavour to address some of the broader manufacturing opportunities in New Zealand?

The NZPA labels this more proactive role as its 'Tomorrow's Economy' workstream. It has already begun small-scale work to bring researchers and like-minded businesses together to collaborate on large-scale opportunities. It refuted the idea that this is 'picking winners'. Instead it states this work occurs when the Advisory Board and staff see individual companies with their own value propositions clustering around an idea (e.g. smart home innovations) and they sense there's a 'sum' that is bigger than the individual parts. Rather than simply ignoring the synergies between projects and historic research, the NZPA staff are now sounding out businesses and researchers as to whether there are collaboration opportunities – or "connecting the dots". Staff noted that if even one of these collaboration opportunities "took off" the economic return for the country would be enormous, far exceeding the small amount spent on the NZPA to support such activity.

The NZPA is currently doing a small amount of proactive activity in this space, but it has stated it feels somewhat constrained due to a lack of funding and a lack of an explicit mandate to lead sectoral conversations (particularly given the activities of others in this area, such as Callaghan Innovation). The NZPA's Tomorrow's Economy work is currently condensing around four workstreams:

- New Zealand's bio transformation (by 2030)
- Nitrogen for crops and pasture, but not going into the water (by 2030)
- A carbon neutral home, demonstrated and ready for implementation (by 2035)
- Clean, renewable energy and energy storage (by 2040)

Businesses we spoke to supported this more proactive role played by the NZPA. One noted that the NZPA effectively acts as a moderator in these pan-business discussions, and they know who to pull

into the process at different stages. Businesses also noted that the NZPA, unlike Callaghan Innovation or Scion, faced no imperative to try to bring in revenue from businesses and were viewed as genuinely trying to help.

Our position on the NZPA's Tomorrow's Economy work

First and foremost, the core focus of the NZPA needs to remain on acting as an intermediary to support businesses to make appropriate connections with researchers. In our view this is best done through the current model of responding to business' individual needs.

- However, in undertaking that work the NZPA staff will necessarily gain unique insights into the areas where there are clusters of aligned interests among businesses and researchers. Where it sees the potential for collaboration opportunities it should pursue them. In our view there is a valuable role in the NZPA helping to identify where its research network can best support sector-wide opportunities.

While the NZPA can help to 'connect the dots' we are not convinced there is a need for a wholesale shift in the NZPA's focus or necessarily a need for large-scale funding increase to support this work. More funding is required for the NZPA to scale up its current activities, and with that will come the opportunity for the NZPA to continue in its efforts to be more proactive and strategic in identifying opportunities. We would support that. We would not support, and do not believe, that the NZPA team is requesting, re-orienting the organisation away to having a national 'industrial policy' focus.

Our view is the wider Tomorrow's Economy work is important and will naturally flow out of its existing business-to-researcher activities. The NZPA should be encouraged to pursue further opportunities. However, it is not always going to be the best placed organisation to play a large-scale co-ordination role or to advocate on behalf of business – in some cases it will need to act as a conduit to put businesses in touch with organisations such as Callaghan Innovation and NZTE.

2.2 Future-state options assessment

[withheld to protect confidentiality of advice]

2.3 A recommended future model

[withheld to protect the confidentiality of advice]

2.4 The NZPA-Callaghan Innovation relationship

What might all this mean for the relationship between Callaghan Innovation and the NZPA? Based on discussions with leaders from the NZPA, Callaghan Innovation, the Advanced Manufacturing ITP Steering Group, and MBIE, as well as stories from our interviews, here are our insights and recommendations:

Clear definitions will help Callaghan Innovation to work more closely with the NZPA

There has been difficulty in clearly articulating the purpose, value proposition, and target customer of the NZPA in the past, which is likely to have contributed to awareness issues nationwide. If this review can clarify these definitions, it will be easier for Callaghan Innovation staff to collaborate with the NZPA on customer referrals, projects, and science expertise.

For easy reference, here are some suggested definitions:

What is the NZPA? A low-risk, technical problem-solving service focused on making research and science work best for industry.

What is the NZPA's value proposition? Because of their prioritisation of deep, collaborative relationships, the NZPA connect to a wide, synergistic network. This allows them to help businesses find the very specific technical expertise that they need in very little time; a process that could take businesses months or years to navigate on their own.

Who is the NZPA's target customer?

- Small- to medium-sized businesses
- Businesses without their own internal R&D team, or with knowledge gaps in their internal R&D
- Businesses that need help identifying exactly what technical expertise they need. The NZPA's networking model allows them to have excellent awareness of the technical possibilities and how to access them, meaning businesses do not need to come to the NZPA with clearly defined needs.

We think it is worth noting here that due to their expertise in technical solutions as opposed to wider business mentoring, the NZPA is less suited to start-up businesses. Start-ups would benefit most from engaging with one of the many startup incubators available in the ecosystem.

What is the NZPA's subject matter expertise?

- soft materials
- recycling and bioprocessing
- manufacturing systems
- materials and surfaces
- sensing and automation
- design innovation

Collaboration between Callaghan Innovation's Research and Development Solutions and the NZPA

To better navigate customer flow through all of Callaghan Innovation's products and services, it makes sense to work towards more alignment between the RDS teams and the NZPA's researchers. One possible way to do this would be for the Research and Development Solutions teams to become members of the NZPA network. This would allow all customers, regardless of whether they first approached Callaghan Innovation or the NZPA, to have easy access to the same array of researchers. It would also allow both organisations to easily fill each other's expertise gaps.

In order for this partnership to work at its best, there would need to be a mutual understanding that both parties are working for the network and therefore are committed to a two-way sharing of expertise, clients, and project opportunities. We suspect there is an opportunity for MBIE and/or Callaghan Innovation to play a leadership role in promoting the idea of a national network that collaborates to achieve a mutual goal for the New Zealand economy.

Coordinated customer engagement pathways

We have heard that Callaghan Innovation, the NZPA, the Bioprocessing Alliance, the NZ Food Innovation Network, Research and Development Solutions, and other Callaghan Innovation initiatives are enthusiastic about working more closely with each other. However, there is some uncertainty about how to navigate and understand each other's engagement models, and how to reduce confusion for businesses trying to find the best R&D team for their problem.

We think it is important that businesses remain able to initially approach any of these organisations according to their location and existing networks, but it is clear there would be benefit in aligning customer engagement pathways across organisations in some way. This would make it easier for all organisations to collaborate on projects and refer customers to each other, further ensuring that businesses receive well-tailored support.

One possible way to do this could be having a system-wide understanding that whichever organisation has the initial engagement with a customer takes the lead over the engagement model and process for that project. For example, if one business approaches the NZPA first and through the needs assessment the NZPA decide to engage RDS scientists, RDS agrees to that partnership on the understanding that they are joining in with the NZPA's engagement model and processes.

2.5 Māori businesses

Given the rights afforded to Māori through Te Tiriti o Waitangi, and the significance of the Māori Economy to the future wellbeing of Tangata Whenua and Aotearoa as a whole, it is important to understand the extent to which the NZPA is providing equitable access to support for Māori businesses as well as non-Māori businesses. We only spoke to several Māori-owned businesses who were clients of the NZPA, but they were very supportive of its approach and the value it provided.

While the NZPA does not have a specifically-designed Kaupapa Māori service, we spoke to several Māori business leaders who, overwhelmingly, had positive experiences with the NZPA.

Māori business leaders told us that the NZPA…

"…work with us, not for us"

The NZPA honours Māori businesses' prioritisation of relationships by inviting manufacturers to be involved at every stage of the project, rather than conducting the bulk of the research in the lab.

"…take the time to understand our context"

Beyond the value this provides to all businesses, Māori leaders reflected the relief they felt in being truly listened to by the NZPA- something they struggled to find elsewhere in the system. This was especially important given some key differences between Māori business and non-Māori business contexts:

- Whanaungatanga tends to be at the forefront of everything that Māori businesses do.
- Māori businesses tend to drive their foci towards benefiting Tangata Whenua and/or Papatūānuku, and away from revenue.

Also, the issues that Māori businesses tend to deal with bring added complexities that more Western-centred businesses do not face, such as navigating systemic structures that were founded on Western models. Complexity adds time, and the NZPA can commit to "being in it for the long haul" due to having no agenda of their own; revenue-based or otherwise.

"…help us protect our intellectual property"

Because indigenous knowledge is held collectively and timelessly,[7] it is sometimes not possible for a Māori business leader to redistribute intellectual property rights to somebody else. This makes many

[7] New Zealand Intellectual Property Office 'Protecting intellectual property with a Māori cultural element: User Guide' www.iponz.govt.nz/assets/pdf/maori-ip/protecting-ip-with-a-maori-cultural-element.pdf

funding and research contracts inaccessible. The fact that the NZPA facilitate IP agreements that work for businesses, removes a major barrier.

"...align with our kaupapa"

The NZPA's prioritisation of connection and relationship, and their lack of financial agenda, naturally align with the core values of Māori businesses.

Through our engagement, we heard that engaging with Māori requires an approach that works for Māori.

For example...

Recognising diverse methodologies

Leaders feel that their tikanga-centred methods aren't always recognised within New Zealand's western-centric systems, meaning they sometimes miss out on support to grow their business. Those that have successfully collaborated with Māori businesses reflect on the importance of giving them the necessary resources before stepping back to let them do what they do best.

Kanohi ki te kanohi

In our experience we have found that engaging with Māori, especially when establishing a new relationship, works best face-to-face before moving online. Māori business leaders that we spoke to highlighted this, adding the importance of meeting at locations relevant to the discussion. One leader described the significance of the NZPA sending their research team to the site which natural materials used on the project were derived from. It was crucial that the local iwi members who were kaitiaki for the resources could meet the people converting them into products.

Unlocking equitable funding access

Māori business leaders had experienced roadblocks in their previous attempts at gaining funding through Government grants.

In order to unlock equality in funding in alignment with Te Tiriti o Waitangi, we heard that Māori business leaders need:

- Intellectual Property agreements that protect collectively-held Taonga Māori
- Application criteria, especially the measures of success and achievement, that are accessible for businesses working in a Māori context
- Traditional knowledge, expertise and methodologies to be considered on an equal par with university qualifications
- Continuity in funding until businesses are confident they can sustain themselves.

- Relationships with funders to be handed over when there are personnel changes in Government so that businesses are not lost track of and have to re-start the application process.

2.6 Operational improvements: our recommendations

Less is more

The deep passion and extensive expertise of the NZPA team often leads them to have a lot of initial conversations and engagements with businesses, and to not screen out potential clients until they understand their business and research needs. Although this is well-intentioned, we recommend that for maximum effectiveness the NZPA focus on excelling at a narrower scope.

We heard this from researchers in our interviews, too. Although they appreciated the potential benefits of being permissive, especially for businesses, some researchers suggested there needed to be a degree of strengthened project screening. Some researchers spoke of their frustration that they were having to expend time and effort on businesses that did not have viable business ideas. We also heard that some Crown Research Institutes would be keener to officially join the NZPA network if they had a more definable focus and purpose.

Upon this feedback, the NZPA reflected that they do say 'no' to projects, but not to engagements, and that perhaps this is not made clear to the research network. A potential way forward would be for the NZPA leadership team to secure an easy and effective way to communicate to research teams about when an engagement will or will not lead to a project.

We also heard from a small handful of businesses that they wish the NZPA had properly assessed their level of capability to do the project and been upfront about this before the contract was signed. They highlighted the importance of the NZPA being able to say 'no' if the capability doesn't line up.

Measuring and reporting

It was clear to us early on that the NZPA needed to find ways of measuring and reporting on their performance that more effectively communicated their true value proposition. Callaghan Innovation clearly has a role to play here too, and we know that work has already begun on creating some new reporting measures.

We heard frequently that one of the main barriers to better reporting was the difficulty in capturing the intangible value the NZPA provides in how it engages with and facilitates collaborative research. Although this is absolutely true, in collaboration with interview participants we brainstormed some ways to capture the true essence of the NZPA as closely as possible.

From 'best practice' literature reviews as well as suggestions from interview participants, **our top recommendations for what the NZPA could measure are below:**

Overall

- Lists of who was involved in each project (to capture the value of the network)
- Qualitative feedback from clients and researchers

- Frequency of contact with the network (e.g. number of emails/calls/meetings)

Students

- Tax number ID (for future LR career outcomes)
- Attrition from PhD programs
- Wages earned
- Number of students sponsored for Masters/PhDs or offered industry placements
- Number of students whose placements/theses extended to full-time industry employment

Companies:

- Tax business number
- Sales, exports linked to an the NZPA project
- Lists of risks averted thanks to technical assistance
- Or any measure of the risk averted due to those fees-free exploratory stages
- Number of facilities accessed by industry through research institutions
- Number of Māori businesses engaged with
- Number of Start-ups vs SMEs vs large/mature businesses engaged with

Researchers:

- External income
- Engagement activities
- Directly related publications
- Number of Māori researchers/scientists/experts involved
- Number of spin-out companies established by universities/businesses
- Number of and value of IP-sharing arrangements

Optimising the effectiveness of Project Leads

Although the NZPA team are very clear on the ideal role of their project leads, it was reflected by businesses, researchers and the NZPA alike that the follow-through of this role could improve in consistency. We heard that the ideal role for project leads includes:

- Being the convenor that understands both the industry and research contexts; helping both parties to understand each other
- Helping the research teams to understand businesses' timeframe needs due to market demands; being the problem-solver that can help find a compromise that suits everybody
- Organising the logistics at the research end so that business leaders do not have to navigate an unfamiliar system
    - One business expressed their deep appreciation for the way that their project lead arranged a large research team: *"He understood the importance of keeping to a quick timeframe, but he knew that this wouldn't suit the university calendar. So, he recruited a large team of about twenty researchers and students so that, between all of their*

calendars and commitments, they could work together to meet our time requirements. You never get that. You never get it anywhere else."

While some businesses sang the praises of the project lead role, others indicated there was room for improvement. To increase the consistency of the clear value of this role, we recommend that a clear job description is written for the project leads. Once the responsibilities are explicit, it will also be easier to assess how much extra resourcing is needed to enable consistent delivery of the value of this role.

Promotion

An important point was made by a Board member:

"Not many people know about us because we can't afford for many people to know about us."

Once the resourcing for the NZPA is scaled up, some dedicated strategizing around promotion is likely to effectively address the visibility concerns that have been raised in previous submissions and strategies.

It is possible that, if business relationship managers were recruited into the NZPA team, increasing promotion could be part of their job descriptions. Either way, we recommend that there be a dedicated role to this, rather than adding more responsibility to the current leadership team.

Dedicated promotion efforts could look like:

- Writing case studies that reflect the essence and value proposition of the NZPA
- Getting work done on the website to maximise its ability to draw stakeholders in
- Collaborating with Callaghan Innovation, University of Auckland, and/or MBIE to spread awareness

Conclusion

As a review team, we have thoroughly enjoyed the opportunity to engage with such key players in Aotearoa's Advanced Manufacturing and Innovation system. We sincerely thank every person that so generously gave us their time, expertise, and thoughts to help us deliver such a comprehensive review. We are looking forward to hearing what happens next.

What is the optimum role for the New Zealand Product Accelerator in growing the value and commercial success of New Zealand's manufacturing sector?

Based on our research findings, we think the NZPA is the best organisation that Aotearoa currently has for connecting manufacturers to research and science.

The NZPA has the potential to role model an ideal way to make RSI work for industry.

With careful strategy to mitigate risks associated with scaling up too quickly, reliance on individuals, and tensions between research-centred and industry-centred attitudes across the system, we see a future where the increased influence of models like the NZPA lead to significant improvements in the health of the New Zealand economy, and ultimately all New Zealanders.

"The story we have to tell is 'it's your Product Accelerator.'"

- *Mark Jones*

Appendices

Appendix A: The role of innovation intermediaries – a review of the international literature

Background

The formal case for why public funds should be used to support science was not widely accepted until Vannevar Bush's classic report, *Science, the Endless Frontier (USA)*,in 1945.[8] Until that time, research was a 'nice-to-have' activity that was neither measured or explicitly funded in the university sector. Recognition that there is a role for intermediaries to facilitate the translation of ideas from universities to industry occurred even later.

Prior to WWII, ad hoc interactions between universities and industry were based on personal relationships and large company sponsorship (e.g., Bell Labs, Du Pont, GM in the USA and IG Farben in Germany). Publicly funded university-industry translation programs arguably began with the US department of defence's need to make key investments in breakthrough technologies for national security and the space industry in the 1960s. The need was great and unfettered market forces were too uncertain and slow. Other developed economies did not recognise or mimic this US translation model until after the 1980s.

The rationale for public sector support for intermediation has now been clearly stated: there are net benefits to broader society (that is, beyond the university and its client business) from translating new ideas into use faster and more efficiently. Various forms of university-industry innovation intermediaries now exist to massage the value chain and exploit underperforming opportunities.

This document is largely a summary of recent articles have reviewed the literature on the role of university-industry research intermediaries.

What is an intermediary?

Intermediaries filter, consolidate, store and communicate information to the right people at the right time. They contribute to the coordination capabilities of innovation systems by coupling complementary parties and re-orientating entities with different incentives and purposes. Their value come comes not only from connecting organisations and individuals with specific interests, but from providing a common framework for communication, stimulating discussion, knowledge exchange and engagement (Kopczynska and Ferreira, 2019).

Innovation intermediaries can be standalone units of universities (e.g., NZAP); embedded in the duties of technology transfer offices; or part of research institutes (e.g., CSIRO Innovation Connections, Fraunhofer); and can be located in science and technology parks, university incubators, industrial

[8] Bush, V., 2020. Science, the endless frontier. Princeton University Press [1945].

associations, development and proof-of-concept centres (e.g., Catapult). They can also be independent agencies (e.g., Bayern Innovativ) (Kopczynska and Ferreira, 2019; Santos, Dias and Mendonça, 2023).

There are no discoverable studies which show that the organisational location of some intermediaries is superior to others. However, it is notable that almost all intermediaries service the STEM (science, technology, engineering and mathematics) disciplines. Translated within the HASS (humanities and social sciences) disciplines tend to be undertaken at the research unit or researcher level.

The main channel for university-industry translation

Intermediaries can assist any channel for university-industry knowledge exchange, although most specialise in one type or another due to the heterogeneity of benefits, barriers and mode of operation. Most attention has been given to commercial channels, but it is not clear that these are more economically valuable than more diffused forms of knowledge transfer.

The main channels encouraging translation are:[9]

- Collaborations & shared spaces (offices, labs, incubators, science parks)
- Staff transfer (including student placements)
- Contract research
- Publications
- Licensing, spinoffs & start-ups
- Conferences, workshops & events

Almost all studies find that (patent) licensing, spinoffs & start-ups are the least preferred and least used form of translation by academics (Nsanzumuhire and Groot, 2020).

Intermediaries can facilitate (perceived) factors driving success in U-I interaction

The translation of ideas does not need a dedicated intermediary. Many discoveries become embodied in usable items with just a bilateral exchange between the inventors and the producer. What an intermediary offers is specialised skill, an innate aptitude for idea translation and acquired contacts and know-how.

The technical feasibility of the idea and its market potential (i.e., cost of production and the size of the market), are key factors in success. These attributes are generally outside the control of the intermediary, although they form part of the criteria for selecting the ideas and projects into which the intermediary will invest.

There are, however, other important factors in the relationship between the universities and industry that an intermediary can influence and have been identified as success factors. We caution however

[9] Nsanzumuhire and Groot, 2020.

that the impact of these factors has been neither well studied or quantified. Most studies are qualitative, descriptive, and based on interviewees' subjective assessments (Feser, 2023; Burbridge and Morrison 2021; for an exception see Jensen, Palangkaraya and Webster 2015).

Although there is a paucity of quantitative studies of the impact of intermediaries, the number of successful deals by the major US technology transfer offices is reputed to be considerably greater than in other developed countries (Chau, Gilman and Serbanica, 2017; Siegel et al. 2008)). This has been attributed to the more established capabilities and reputation within the US system and its economies of scale. Experience matters and existing collaborative agreements tend to stimulate further collaboration among firms in part because of long-term cultural change (Sjöö and Hellström 2019).

The main factors identified in the literature are as follows.

Trust between key researchers & champions

Trust—which is defined as '...confidence in an exchange partner's reliability and integrity' (Morgan and Hunt, 1994, p. 23) – is considered in the literature to be the most important driver of success. Trust is engendered by having multiple points of contact between the parties, developing a reputation as an honest partner, using boundary spanners to facilitate clear communication and frequent use of face-to-face interaction.

According to Mowery (1983) and Pisano (1990) the significant presence of uncertainty, non-codifiability and opacity in R&D transactions can erode confidence to the point no market transaction takes place. Uncertainty about cost or the market can create an expectation that ex post renegotiations will be needed later as unforeseeable circumstances unfold. If there is a fear that the other party will behave opportunistically, parties may choose not to transact with each other (Williamson, 1985). Where it is difficult to codify the nature of the product traded, parties may fail to trade if there is reason to believe the other party will act on the literal terms—rather than the spirit—of the agreement. Finally, when quality of the R&D is opaque—if, for example, quality is only revealed through use—then an exchange can also fail to occur as it is hard to agree on a price (in addition to moral hazard concerns).

Trust is needed to overcome these risks (Jensen, Palangkaraya and Webster 2015). Trust allows one to predict how the other party will behave when unknown contingencies arise. Unexpected contingencies are common in innovation given the inherent uncertainty involved in dealing with subject matter that is new-to-the-world and accordingly for which no data is available. Jensen, Palangkaraya and Webster (2015) estimate using data on over 700 research transactions that a high level of trust—as represented by prior business dealings—increases the probability of transaction success by between 6 and 23%.

Trust is strong when reciprocal and continual communication occurs and when parties capitalise on existing relationships. The presence and behaviour of innovation champions from both parties is crucial and it is the behaviour of these leaders that set the baseline for trust (Hemmert, Bstieler and Okamuro, 2014; Sjöö and Hellström 2019; De Wit-de Vries et al 2019).

Many studies reiterate the need for fora and spaces where parties can meet and connect to each other, such as jointly hosting forums, meetings, conferences, joint centres, staff exchanges, study visits, advisory boards and collaborative curriculum development (Chau, Gilman and Serbanica, 2017;

Rossoni, de Vasconcellos, and de Castilho Rossoni 2023). These 'meeting places' include industry-funded PhD students, staff transfer, and personal relationships forged through work. They facilitate an understanding of the parties' routines and expectations (Sjöö and Hellström 2019). Intermediaries have a role in designing these 'meeting places' to encourage organisations and individuals to communicate and share resources between each other.

Expecting individual researchers and industry personnel to design and operate these networking and collaborative activities is risky as neither party is trained or selected for these skills. However, there is a trade-off from using third party brokers. To be effective, dedicated intermediaries need a high degree of familiarity with the discipline and its related industry. They inevitably therefore focus on a few areas, and this can result in some valuable areas of research not being served.

Cognitive distance

Successful university-industry interactions depend on the ability of universities to understand the issues facing the industry partner and the industry partner to articulate their problems and understand how science can apply to commercial ends (Chau, Gilman and Serbanica, 2017)

Intermediaries have a clear role to make explicit implicit understandings, bridge cognitive differences and identify ambiguities. Although communication may resolve many ambiguities, researchers and industry people consumed with operational issues do not have the time and expertise to undertake these boundary spanning activities. Intermediaries facilitate the conversion and translation of academic results to the context of the firm and vice versa (De Wit-de Vries et al 2019).

Contractual safeguards

Contractual safeguards are agreements to clarify the understanding of each other's roles (Hemmert, Bstieler and Okamuro, 2014). They reduce uncertainty especially when parties are new to a collaboration.

Lack of clear expectations of the outputs from a collaboration, or joint activity, from the beginning of a project can lead to legal quarrelling and a breakdown in trust. There is often a trade-off between simplicity and contractual certainty. Although formal IP only applies to select subject matters, clarity over ownership, in the form of a term sheet, from the outset can pre-empt later conflicts. It can also give confidence to downstream investors who may need exclusive rights in order to take the idea to market.

Nonetheless, use of IP needs to proceed with caution as an excessive legal framework is generally seen as counterproductive – expensive and time consuming (Sjöö and Hellström 2019). Legal contracts can only do so much in the presence of non-codifiability and opacity.

Clashing cultures of openness and secrecy

There is a strong culture within universities in favour of scientific performance and liberal and open communication channels. Industry however must make a financial return on their investments, and this can necessitate privatising information through secrecy and legal rights (noting that trade secrets are the most common way industry appropriates their innovation profits). University researchers can

resent time and content restrictions on their ability to publish, and industry can be wary of the inadvertent leakage from loose conversations.

These problems are overcome by establishing explicit and clear expectations from the outset, setting time limits on secrecy and financially compensating universities for the privatisation of their ideas. Again, a simple term sheet can be useful here. Trust and regular communication between parties helps find common cultural ground (Hemmert, Bstieler and Okamuro, 2014; Rossoni, de Vasconcellos, and de Castilho Rossoni 2023). Intermediaries have a role to play training university researchers to navigate around the open science versus secrecy landscape.

Alignment of missions

A shared understanding of the issues (communication, selection) and alignment of motives has also been associated with a greater probability of a successful transaction. Jensen, Palangkaraya and Webster (2015) estimate using data on over 700 research transactions found that an alignment of motives between buyers and sellers in the market for R&D increases the probability of transaction success by between 2 and 5%.

It is unlikely that intermediaries can change the motivations of many public sector research scientists, however part of their skill is being able to identify researchers who have the interest and ability to adapt to industry needs.

Time horizons

Cultural differences also extend to modes of communication, time horizons and processes especially rules and regulations imposed by universities or government agencies. Many of these barriers can be surmounted but if the innovation is time critical, an experienced intermediary can be critical (Rossoni, de Vasconcellos, and de Castilho Rossoni 2023).

References

Baleeiro Passos, J., Valle Enrique, D., Costa Dutra, C. and Schwengber ten Caten, C., 2023. University industry collaboration process: a systematic review of literature. *International Journal of Innovation Science*, *15*(3), pp.479-506.

Burbridge, M. and Morrison, G.M., 2021. A systematic literature review of partnership development at the university–industry–government nexus. *Sustainability*, *13*(24), p.13780.

Bush, V., 2020. *Science, the endless frontier*. Princeton University Press [1945].

Chau, V.S., Gilman, M. and Serbanica, C., 2017. Aligning university–industry interactions: The role of boundary spanning in intellectual capital transfer. *Technological Forecasting and Social Change*, *123*, pp.199-209.

Crișan, E.L., Salanță, I.I., Beleiu, I.N., Bordean, O.N. and Bunduchi, R., 2021. A systematic literature review on accelerators. *The Journal of Technology Transfer*, *46*, pp.62-89.

De Wit-de Vries, E., Dolfsma, W.A., van der Windt, H.J. and Gerkema, M.P., 2019. Knowledge transfer in university–industry research partnerships: a review. *The Journal of Technology Transfer*, *44*, pp.1236-1255.

Feser, D., 2023. Innovation intermediaries revised: a systematic literature review on innovation intermediaries' role for knowledge sharing. *Review of Managerial Science*, *17*(5), pp.1827-1862.

Hemmert, M., Bstieler, L. and Okamuro, H., 2014. Bridging the cultural divide: Trust formation in university–industry research collaborations in the US, Japan, and South Korea. *Technovation*, *34*(10), pp.605-616.

Jensen, P.H., Palangkaraya, A. and Webster, E., 2015. Trust and the market for technology. *Research Policy*, *44*(2), pp.340-356.

Kopczynska, E. and Ferreira, J.J., 2019. How to build intermediary-based strategy for enabling university-industry communication? In *ISPIM Conference Proceedings* (pp. 1-16). The International Society for Professional Innovation Management (ISPIM).

Mowery, D.C., 1983. The relationship between intrafirm and contractual forms of industrial research in American manufacturing, 1900–1940. *Explorations in economic history*, *20*(4), pp.351-374.

Nsanzumuhire, S.U. and Groot, W., 2020. Context perspective on University-Industry Collaboration processes: A systematic review of literature. *Journal of cleaner production*, *258*, p.120861.

Pisano, G.P., 1990. The R&D boundaries of the firm: an empirical analysis. *Administrative science quarterly*, pp.153-176.

Rossoni, A.L., de Vasconcellos, E.P.G. and de Castilho Rossoni, R.L., 2023. Barriers and facilitators of university-industry collaboration for research, development and innovation: a systematic review. *Management Review Quarterly*, pp.1-37.

Santos, T.N., Dias, J.G. and Mendonça, S., 2023. University–industry cooperation: a taxonomy of intermediaries. *Science and Public Policy*, *50*(3), pp.457-490.

Sjöö, K. and Hellström, T., 2019. University–industry collaboration: A literature review and synthesis. *Industry and higher education*, *33*(4), pp.275-285.

Williamson, O.E., 2007. *The economic institutions of capitalism. Firms, markets, relational contracting* (pp. 61-75). Gabler.

Appendix B: Survey results

We sent out two surveys—to the NZPA's users and non-users. The users survey was sent out by the NZPA and resulted in 2020 responses. For the non-users survey, we asked several organisations (including Manufacturing NZ, the Southland, Otago Regional Engineering Collective, NZTE and HERA) to circulate a survey to businesses in their networks.

User survey results

We received 120 responses to a survey that was circulated by the NZPA to businesses it had interacted with. The users survey was separated into three parts. The first aiming to understand the demographics of businesses accessing the NZPA's services, the second eliciting the nature of their engagements, and the third understanding their overall experience.

The NZPA's users are largely manufacturing startups based in Auckland

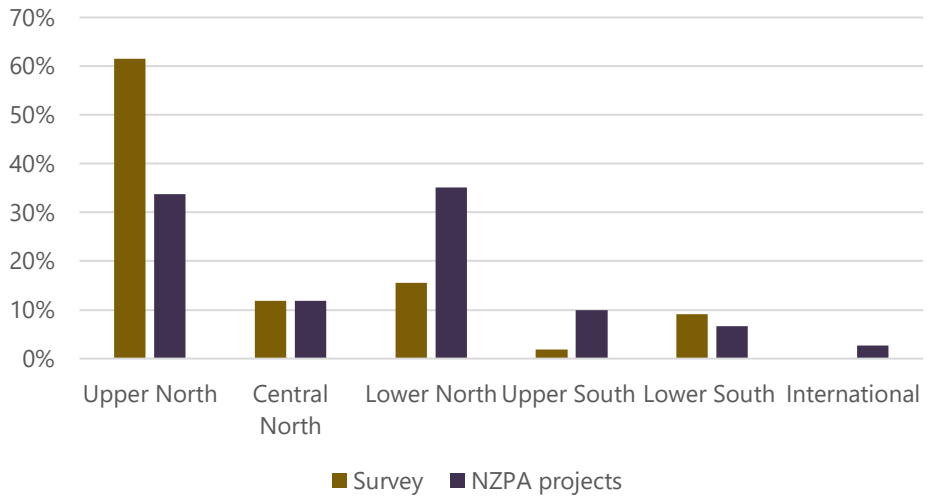
To understand the NZPA's user base, we asked survey questions about users' business size, location, industry, and research and development spend.

53% of users self-assessed themselves as being in the 'startup' phase of business. The other three phases—market introduction, growth, and mature—had a reasonably equal share of the remaining amount. We note that 61% of the users surveyed had not received any other government assistance before accessing the NZPA.

Users were asked to select what industry they were in using standard ANZSIC categorisations. 40% selected manufacturing, with 27% selecting the "other" category. We note that a many of the "other" category can be attributed to manufacturing based on the descriptions.

Respondents were asked to select their primary base of operations. The majority pf users resided in the Upper North Island. When compared to the NZPA's data on projects since 2019, our survey respondents were located proportionately more in the upper north island, whereas the NZPA's projects were located in the Lower North Island. The difference can be seen in Figure 7 below.

Figure 7: Location of projects



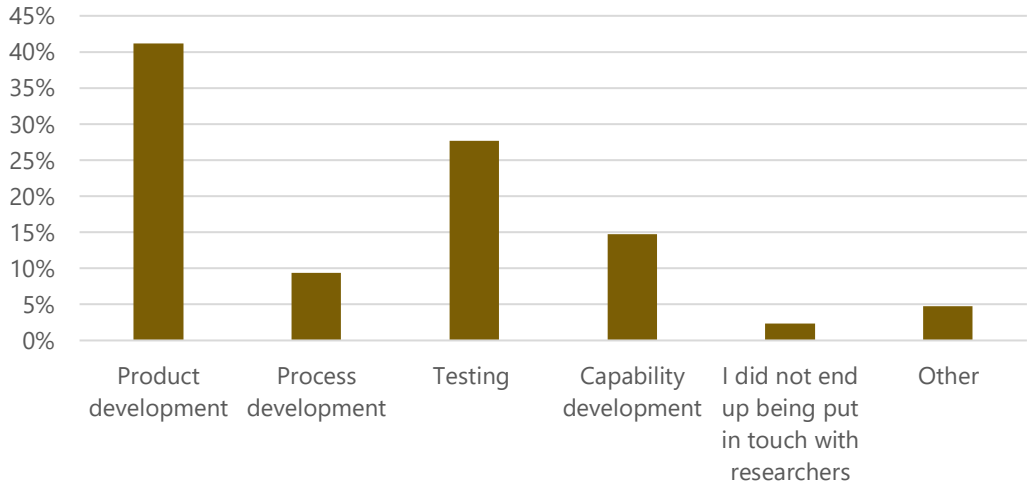
Respondents received varying degrees and types of support

The users surveyed were made aware of the NZPA through various channels. 38% of respondents were made aware of the NZPA via other businesses or an individual (i.e. word of mouth) and 20% via the NZPA approaching them (i.e. circa research push). The remaining respondents were connected through a wide range of channels, with several noting their referrer as a tertiary organisation.

49% of respondents stated that their project led to a stage where they formally contracted a research institution on a fee-for-service basis. We note that this likely reflects who the survey was sent to rather than a reflection of the conversion rate of all engagements. Of those businesses that had a fee-for-service arrangement, 23% had a spin-off company that was set up in partnership with the research institution.

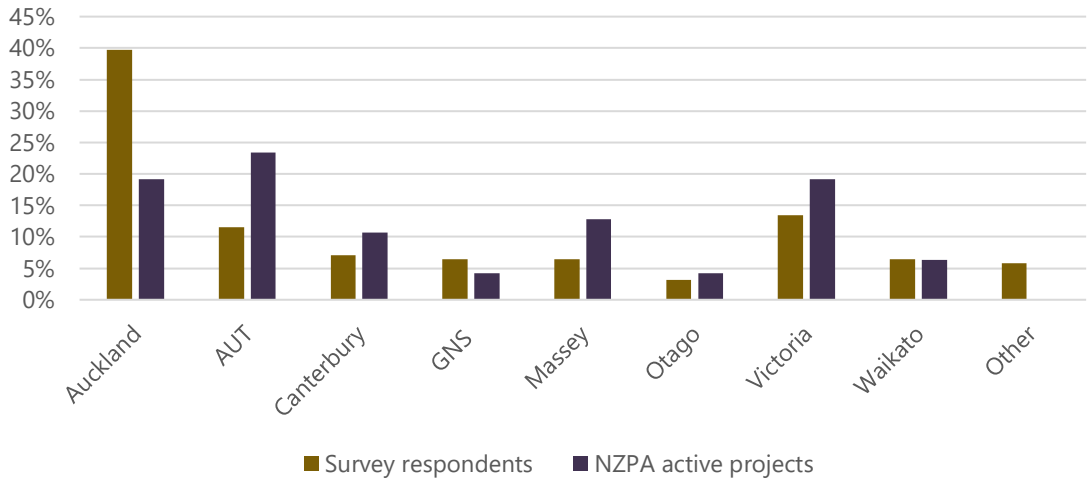
The nature of the engagements was largely focused on product development (41%) and product testing (28%).

Figure 8: Nature of engagement with the NZPA



Users were connected to the eight institutions that are part of the NZPA. The University ofAuckland was the main institution users were connected to (40%), with a reasonably even spread across the remaining seven. When compared to the NZPA's data on active projects, the NZPA's active projects are a lot more evenly spread across the eight institutions. We have hypothesised that survey respondents were likely connected with the University of Auckland, when in reality they have been engaging with the core the NZPA team on project scoping issues (not a formal research project).

Figure 9: Institutions users were connected to via the NZPA

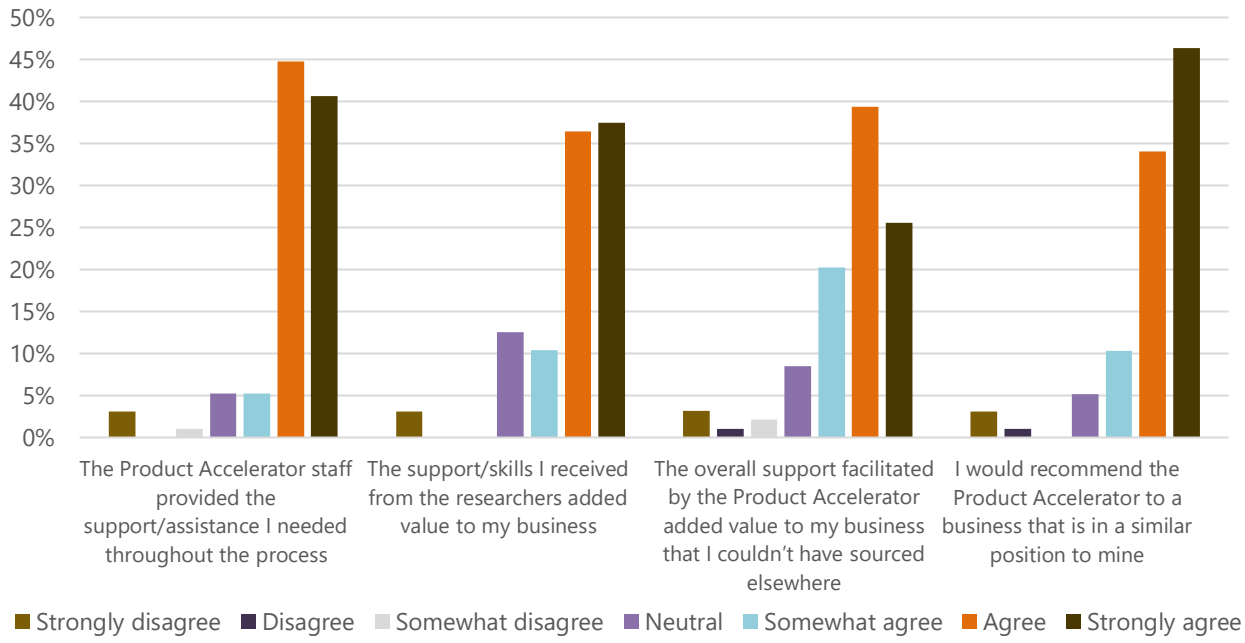


Feedback on the NZPA was overwhelmingly positive

Across all questions reviewing the NZPA's services, feedback was positive. Users agreed that the NZPA provided support/assistance needed (45% agreed and 41% strongly agreed), that the NZPA added value to their business that could not be sourced elsewhere (39% agreed and 26% strongly agreed), and that they would recommend the NZPA to others (34% agreed and 46% strongly agreed). 54% of surveyed businesses stated they had explored more than one issue with the NZPA.

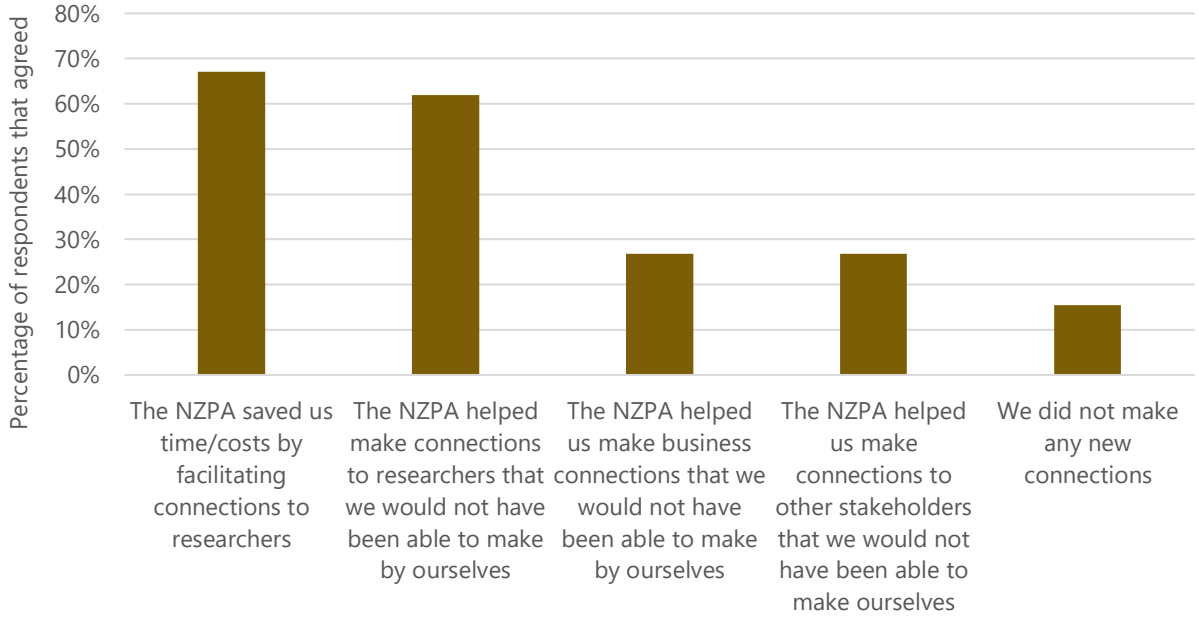
We examined these responses as they related to company types and found that they broadly held. However, two out of the 14 mature companies "strongly disagreed" with all four statements. The small sample size means it is not possible to determine whether these two respondents were outliers.

Figure 10: Degree of support for four statements about the NZPA



We asked survey respondents on whether they agreed with four statements regarding the value of connections facilitated by the NZPA. These results are shown in Figure 11. The majority of respondents agreed that the NZPA saved them time and costs by facilitating connections to researchers (67%), and that they would likely not have been able to connect with these researchers by themselves (62%). However, there was less agreement with the NZPA facilitating connections to businesses and other stakeholders. This observation reflects the research orientated nature of the NZPA's subcontractors.

Figure 11: Respondents that agreed with the following statements about connections



We also asked users to note the value provided by the NZPA's service. While the figures are

necessarily ambiguous, they provide an indication of the benefit provided by the NZPA to the innovation ecosystem. The figures provided ranged from $20,000 to $40,000,000, with a median estimate of $125,000.

22% of respondents stated that the NZPA's services could be improved. Suggestions were varied. However, better articulating the NZPA's value proposition, including marketing its services, was noted by a few.

We left a box or further comments at the end of the survey. 32 out of the 36 commenters commended the NZPA on excellent performance. The quote below captures the essence of these comments:

> "When exploring the NZ R&D Eco-system with a view to finding a research provider or partner, no one does this better than the NZPA."

Non-user survey

The non-user survey was sent out to businesses by four organisations, including with links being shared via social media, emails and regular monthly newsletters. It proved challenging to get non-users to complete a survey and we received only 31 responses.

Nevertheless, the insights from this survey remain valuable, particularly as the surveyed companies are likely to represent a subset of manufacturing companies who are highly engaged and potentially looking for growth opportunities. For example, 92% of respondents to the non-user survey had received some form of business assistance or grants from a government agency (compared to 39% of NZPA users).

There is not widespread awareness of the NZPA

Of those manufacturing businesses that completed the survey, only 39% were aware of the NZPA.

Those businesses who were aware, but hadn't used, the NZPA highlighted that they did not face challenges developing new products or using new technologies (40% faced challenges). Respondents also noted a preference to keep their R&D internal to their company.

There are likely to be opportunities to expand the NZPA's activities

Of those manufacturing businesses who were unaware of the NZPA (61%), 67% stated that they faced challenges developing new products or using new technologies. Businesses noted that their R&D requirements are highly technical, expensive and that it can be challenging finding specialist resources in New Zealand.

We then explained to those businesses the NZPA's services and asked it they could foresee a scenario where their business might use the NZPA in the next five years. 80% of businesses who were unaware of the NZPA stated they could foresee a need to make use of such a service.

Appendix C: Breakeven analysis

Callaghan Innovation requested a breakeven analysis for an annual $2.1 million investment in the New Zealand Product Accelerator (the NZPA). The focus is on the fiscal impacts of the investment to government, i.e. broader economic and societal impacts from the NZPA's activities are ignored.

The results of this analysis show the NZPA's activities need to create $23.4 million of annual incremental revenue for businesses for the government to receive its investment back through incremental tax revenues. Our observation is that this incremental revenue breakeven point appears relatively small compared to the NZPA's outputs – and that is without considering the wider spillover benefits associated with supporting the advanced manufacturing sector.

Methodology of the analysis

At a high level, the method involves:

1. Disaggregating the NZPA users into three company types—startups, companies in a growth phase, and mature companies.
2. Each company types' tax revenue is assessed as it pertains to GST, PAYE, and corporate tax. Combined, these estimate an average tax rate for each company type.
3. A weighted average tax rate for the NZPA's company's is computed using the average tax rates and disaggregation of the NZPA's users.
4. The weighted average tax rate is used to estimate the incremental revenue that the NZPA needs companies to generate for the $2.1 million investment to breakeven.

Startup, Growth, and Mature companies

Companies were categorised as either startups, in a growth phase, or mature.

- Startup companies are defined as companies that are in the product design, conception, and testing phases of business. We also include initial product launches in this category. A survey of the NZPA's users states that 67% of users are startups with a median of three FTEs.[10]
- The growth phase occurs after a company's initial release of a product when it observes sales accelerating. This phase is characterised by high growth and expansion. The survey shows that 17% of the NZPA's users are in this category with a median of 6.5 FTEs.
- Mature companies are established enterprises that have progressed beyond the high growth phase. They generally have a stable market presence, established customer base, and the product has reached peak demand. The survey shows that 15% of the NZPA's users are in this category with a median of 200 FTEs.

[10] We use the median FTEs given the high variability and (relatively) low number of responses causes outliers to distort the average.

Tax revenue collected

Companies generate tax revenue for Government through GST, PAYE, and corporate tax.

GST was estimated on the gross profit of each company type

GST is collected on almost all goods and services produced in New Zealand at a flat rate of 15%. The incremental GST created by the NZPA's businesses is estimated as the difference between GST on sales (total GST), and the GST on cost of goods sold (already incurred GST). Sales minus cost of goods sold is also referred to as gross profit. For simplicity, we assume that GST is collected on all goods in our estimation.

We were unable to find data on gross profit for manufacturing businesses disaggregated by size. Instead, we computed the average gross profit percentage for all manufacturing businesses (using Statistics NZ's (Stats NZ) Business financial data) and applied this rate to all company types.

The flat gross profit percentage was applied to each company types' average revenue. The average revenue figures were sourced from Stats NZ's Annual Enterprise Survey (AES) data. We were able to map our company types, and their respective FTE counts, to the categories in the AES. We attributed startup companies to the AES category of one to five FTEs, growth companies to the AES category of six to nine FTEs, and mature companies to the AES category of over 100 FTEs.

Applying 15% GST to the flat gross profit percentage and the respective average revenue approximates the GST earned by each company type.

PAYE is charged on all salaries and wages

PAYE is charged on all salaries and wages paid out by a company. We estimate the PAYE collected using each company types' average FTEs, average salary, and the tax charged on this average salary.

Average salaries are provided in the AES data, using the previously stated mappings. The PAYE on the average salaries is estimated using the applicable marginal tax brackets. Multiplying the tax charged by the average FTEs for each company type results in the total PAYE charged. For example, startups have an average salary of $59,618 and resulting PAYE of $10,905. Multiplied by an average 3 FTEs, this results in PAYE of $32,716.

Corporate tax is charged on all net profit

A flat rate of 28% is charged on all net profit. Net profit for each company type is computed using the respective AES category's operating profit and applying the corporate tax rate.

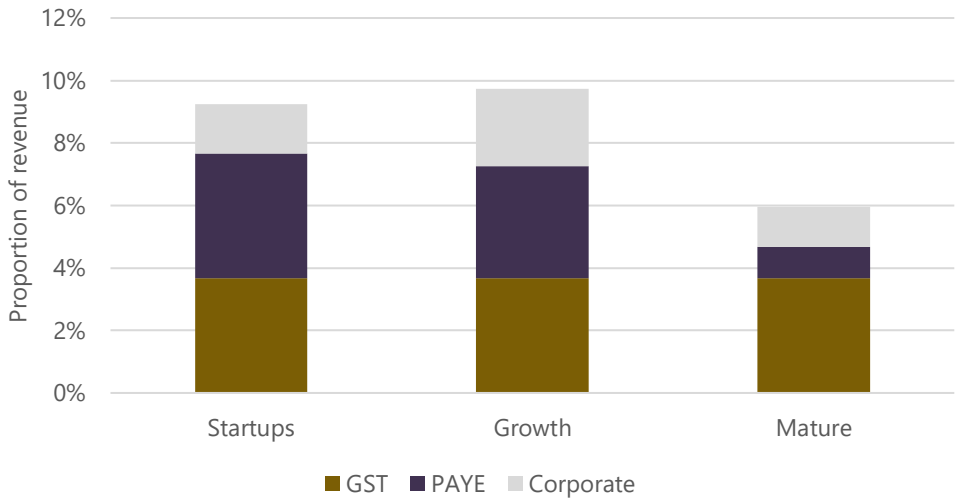
Weighted average tax rate for the NZPA's companies

A weighted average tax rate for the NZPA's companies is computed using the average tax rates (as a proportion of revenue) of each company type and applying weights based on the proportion of companies that access the NZPA's services.

Each company types' average tax rate is estimated by summing the total tax paid and dividing by total revenue. For startups, it is equal to 9.2%, for growth companies 9.7%, and for mature companies it is equal to 6.0%.

The figure below summarises the tax collected, as a proportion of the company types' revenue. Mature companies generate less revenue than startups and growth companies. Mature companies have a relatively average lower tax rate because they have a lower proportion of salaries to total revenue and also a lower proportion of net profit to revenue.

Figure 12: Tax collected by company type



Weighting these averages using the proportion of access stated in section 0 results in an average tax rate of 8.8% for the NZPA users. This average tax rate can be extrapolated to estimate the breakeven point of investment in the NZPA.

Results

Incremental revenue of $23.4 million is required for a $2.1 million investment in the NZPA to breakeven.

To put this figure in context, the NZPA has completed 190 projects since 2019. Of these projects, some provided a "potential value of product" (PVP) figure, at a total value of $1,700 million.[11] This figure is roughly $425 million annually or 18 times greater than the revenue required to breakeven.

We highlight that this figure does not include all completed projects and also does not include the value provided by the NZPA's engagements, for which there is anecdotal evidence of. Overall, the evidence suggests that the $23.4 million of incremental revenue required for the NZPA to breakeven is likely generated from its activities.

[11] While PVP is not a perfect substitute for incremental revenue, it can be used as a crude proxy.

Appendix D: Future state options analysis

[withheld to protect confidentiality of advice]