Te Mana Tangata Whakawhanake
MacDiarmid Institute
Advanced Materials & Nanotechnology

Submission on Te Ara Paerangi
15 March 2022

Executive summary

As a New Zealand Centre of Research Excellence, the MacDiarmid Institute brings together researchers from diverse fields and institutions, with the mission of enabling ambitious science outcomes that deliver on many of the key sustainability changes facing Aotearoa. Our strategy – which we would argue has been highly successful – is to support and empower our researchers, and we believe that this approach should underpin the desired structural changes foreseen in Te Ara Paerangi. The workforce will inform and be informed by research priorities; funding will be most effectively used when it empowers researchers; and institutional connectivity will be enhanced when career pressures due to precarity and equity concerns are alleviated. Can we be brave enough to put researchers at the centre of the redesign of our research system?

We offer the following recommendations on the various matters raised in the green paper, which are each individually addressed in more detail (by topic) in the following pages. We attempt to focus here on process – in particular, reflecting on how the research community can be empowered to achieve the desired outcomes, and avoid the perverse incentives that plague many changes in the research sector – rather than trying to provide specific answers about what specific research priorities should be, or the details of individual funding mechanisms.

We would also note that, as a TEC-funded CoRE, our strategic interests are somewhat decoupled from processes of MBIE funding (though as researchers we have significant experience with the current system). We are keen to continue to engage in the next steps of the research system redesign, wherever researchers' perspectives will be most useful in providing further feedback.

Key comments and recommendations:

1. Research priorities should be kept sufficiently high-level to not create perverse incentives and conflicts of interest. They should be focused on enabling research that is both difficult and important, rather than being too specifically outcome based.
2. We would recommend against a centralized commercialization function supporting start-ups, in favour of better resourcing and aligning entities such as Technology Transfer Offices (TTOs) to maintain relationship-based support processes and resourcing underlying research capacity.

3. We support the suggestion of an umbrella DSIR/CSIRO like model for the CRI sector. This should allow discipline- and sector-specific support for researchers and their work by using different models of financial operation for different sectors (perhaps a tiered structure). It will also minimize unhealthy competition and enhance the ability for new areas of research importance to emerge, including the integration of social science with technological development.
4. Funding mechanisms should be assessed according to their delivery on policy. For example, if the goal is to raise private investment in R&D, it is arguable that the current Smart Ideas mechanism could be enhanced in consideration of private venture capital funding that is now supporting many innovative ideas. Ideally, policy goals should be sufficiently high-level such that the overall structure of the funding mechanism is not frequently in need of revision, but that adjustments can be made based on review (see for example, published Marsden fund reviews of impact and equity outcomes). The goal of increasing private investment in R&D should not be allowed to obscure that Government investment in R&D needs to increase rapidly to meet OECD standards.
5. We would recommend that efforts to establish a Te Tiriti-led research sector engage strongly with the education sector. We note that equity strategies need to avoid being deficit-model based: thus, perhaps counterintuitively, we would argue that making te reo Māori an essential part of the school curriculum might be one of the best ways to improve the pipeline of Māori in science.
6. We strongly recommend the establishment of national standards for PhD stipends, potentially though not necessarily through a centrally administered scheme. Government-funded scholarship levels from the early 2000s (the TEC managed Top Achiever Doctoral Scholarship programme) would be $48,000/annum accounting for inflation, while the average PhD student now receives close to half that amount (with the Marsden Fund and the MacDiarmid Institute having only just recently moved to $35,000).
7. We strongly recommend the establishment of a nationally contestable postdoctoral fund to support the development of the best ideas from PhD level research for both academic and private-sector application. In our experience such support is not merely about academic careers as often misconstrued, but about maximizing the impact that talented graduates are able to make for economic and societal benefit.
8. We recommend that coordination within research communities be an essential component of cases made for nationally important infrastructure, and that the coupling of expertise to infrastructure not be neglected (including technical staff, industry, and regulatory expertise).

Research priorities:

The need for research priorities to exist, in some form or another, is clear. If not put in place by design, they tend to emerge via less transparent processes, such as simply weight of numbers (the balance of researchers in different fields). They can stagnate without explicit processes by which they can be refreshed. However they have associated dangers:

- 'Picking winners' is always a challenge, and when attempted by government can lead to the politicization of research, which we would strongly argue should be avoided in the interest of the stability that is needed by the research community for the development of expertise and its effective deployment. The more specific the priorities, the more we would argue that room needs to be left explicitly for the support of areas of research that emerge from expertise, as investigator-led. One example that comes to mind is that Te Punaha Matatini is not actually an infectious disease institute; in addition, while the MacDiarmid Institute has a very clearly defined 8 year plan that aims to deliver on very specific sustainability-related scientific goals, we have also dedicated a significant amount of funding to our Emerging Science Plan, which aims to support new ideas that emerge over time that do not align with the pre-defined goals but that have potential for significant impact. A balance is needed here.

- The process that led to the formation of the National Science Challenges was widely critiqued for apparent disciplinary bias and conflicts of interest. While we have no desire to revisit the details of that discussion, and recognize the subsequent work put in by the research community to get the Challenges off the ground, we would caution that any process that seeks to define priorities will be seen as a both a threat and an opportunity by many in the research system. The process itself needs to be thought through in the context of whatever changes to the CRI system are decided upon – the two matters are tightly coupled and duplication of process should be avoided.
- Research priorities should be kept sufficiently high-level to not create perverse incentives and conflicts of interest. They should be focused on enabling researchers to engage in research that is both difficult and important.This might mean, for example, supporting interdisciplinary research; incorporating social science into technological development; or building bridges between science and Mātauranga. The danger is that more specific foci create silos. Having said this, any prioritization of research areas – even these difficult and emerging spaces that need support – can be counterproductive unless discipline-specific work is sufficiently well supported. The Marsden Fund is in many ways the engine room of our research system, from which other, more targeted and directed schemes can be fed. Keeping it well fuelled – by which we mean funded – is essential.
- The relationship between 'important' and 'difficult' research is crucial to understand in any priority-setting process. While the research policy community in Aotearoa has been using the terms 'mission-led' and 'investigator-led', and the distinction between 'applied' and 'basic' research is common also, our experience is that the two are mutually dependent and not always so easily distinguishable. Often, important scientific challenges are important precisely because they are difficult, and incremental approaches have not, and remain unlikely to, provide valuable solutions to the problem. Centering fundamental advances in knowledge on creating solutions to important technological and societal challenges is crucial and is often not well dealt with within this oppositional paradigm.

To reiterate our thoughts regarding the centrality of the research community to the process, it is worth pointing out that researchers are often better positioned than government for horizon-scanning and should be used for this. But thought should be put into avoiding conflicts of interest before engaging the research community – for example, by engaging researchers in particular fields in discussing what their collective expertise should best be used for, rather than allowing a free for all of contestability between scientific disciplines, where the threat of total funding loss is inherently much greater. Our experience in planning the 8-year research programmes of the MacDiarmid Institute is precisely this: that predefined areas of research focus and aspirational goals allow excellent collaboration and new investigator-led ideas to emerge, given a sufficiently long-term time frame for fundamental scientific challenges to be realistically targeted. We would also argue that holistic models of impact assessment – that assess programmes, institutes, or funds for their impact over appropriate timescales – make much more sense than treating impact as a matter for every researcher to report on for every funded project. Coarse-graining impact assessments is both more efficient and more meaningful.

Institutions:

It is positive to see the CRI report being picked up here, and the need for greater connectivity (and less unproductive competition resulting from current financial models). As a national scale institute involving researchers at five of our universities, a CRI, and partnered with Callaghan Innovation, we know the value of connectivity. Beyond this, we would point to the ability for scientific refresh to occur in a healthy way (without disruptive workforce impacts) as a second key concern. It is notable that, since 1992, we have lost 3 CRIs – and yet it seems impossible to imagine the creation of a new CRI to address emerging challenges faced by Aotearoa (climate change perhaps being an example). Resistance from existing CRIs to sharing the funding pool available is natural, but a perversion of the system. It restricts and adversely affects both the quality of science that can be done, and the career

paths for CRI scientists, and we would advocate – once again putting researchers at the centre of our arguments – for institutional and financial structures that are enabling of research work, rather than limiting.

We support the idea of a revised DSIR / CSIRO model that would allow for internal restructuring to occur, mitigating some of the currently noted issues. The particular subunits – institutes? – of such an umbrella organization would need to retain some diversity of financial model, but in such a system this could be explicit – institutes could even be grouped and structured according to their level of service delivery for industry, or support of emerging economic and social need. This would be similar to the tiered nature of the Frauenhofer/Leibniz/Max Planck Institutes in Germany, for example (though we acknowledge the different scale of operations).

Connectivity between institutions and industry

If the private sector is to be convinced to invest more in research (to contribute to raising the investment in R&D to 2% of GDP by 2027) there needs to be a clear value proposition and a streamlined way of accessing this value. Current challenges include:

- Non-standard IP policies across institutions.
- Non-transparent terms and pricing of fee for service work by researchers.
- Low level of institutional support for researchers to spend time understanding industry problems and R&D opportunities (including lack of funding for feasibility work that gets researchers up to speed with the industry problem).
- Low ratios of professional staff with responsibility for commercial engagement (and funding for them) relative to numbers of researchers within research institutions.
- Low levels of experience/expertise/specialised talent within commercialisation staff and a high turnover.
- Lack of transparent and accessible structures to identify and clearly define major industry priorities in a way that then leads to funding support for research in these areas.

Research commercialization (start-ups)

Although research commercialization would benefit from greater scale (more resource to support internationally competitive companies being developed), this should not come at the expense of close relationships between researchers and commercialization support professionals. The MacDiarmid Institute has a good balance between supporting commercialization activities (including capability building, developing collaborative groups, and funding), while not adding a further claim to the IP ownership or adding further distance between researchers and the commercialization professionals who support them. If any consideration of a single, centralized commercialization function were to be feasible it would need to ensure that commercialization staff are in-situ with researchers, highly accessible and that no new barriers to IP sharing were created.

Providing more resource (FTE, project funding and training and development) to commercialization functions within each institution would enable better support, balanced by maintaining close relationships and researcher access. Experience working in partnership with Callaghan Innovation has shown how challenging it would be to centralise many of these functions.

A further challenge to successful company formation and support is the current need for research institutes to hold start-ups on their balance sheets, distorting the reported value that start-ups have to the institutes (current book valuation, which is highly speculative, as compared to future value to the country through employment, as well as attracting research talent and students to the institute).

We would, on balance, recommend against a centralized commercialization function supporting start-ups, in favour of better resourcing Technology Transfer Offices (TTOs) and similar entities within CRIs to maintain a relationship-based support process.

Funding:

As a CoRE, we'd like to make a particular comment on the attributes of CoRE funding that make it such a successful scheme. Nationwide, collaborative, long-term funding schemes with a focus on people – both our established researchers and the emerging researchers we train – work. As researchers who sometimes spend time writing policy submissions that point out the need to increase government funding for research, we are committed to using all resource to support research as effectively as possible, and manage our balance between core (stable) and contestable funding carefully to ensure this. We are well aware, as researchers, that we live on fixed research incomes: more and more, we are grappling with the ethical issues that arise when our funding-limited decisions impact on the stipends our students have to live on. Weighting up support for PhD students versus support for postdoctoral fellows is also a fraught matter: we also comment on the need for structural intervention on that below.

The funding system is critical to everything covered within Te Ara Paerangi. Here we will divide our comment into the operation of the contestable system, and the core funding of CRIs and Universities, in order to best comment on workforce implications and the how perverse incentives arise (and may hopefully be avoided).

Contestable funding

- The key purpose of contestability is to enable the selection of the best ideas. Too often, our system mistakes this for the selection of the best people, with devastating impacts on our Early Career Researchers (ECRs) unless they are explicitly prioritised. This is a key weakness of contestability that needs to be countered by explicit funding provisions, such as postdoctoral funding (see further comments below under *'The Research Workforce'*).

9. The 'best ideas' are always subject to the criteria of the funding scheme, as codified in the application structure and in instructions to referees. Stability of funding mechanisms can in fact be enhanced if adjustments can be regularly made based on review of delivery of the scheme (see for example, Marsden fund reviews of impact and equity outcomes).

- We would argue that the purpose of the funding scheme needs to be explicitly determined by government (by MBIE in the case of MBIE funds – e.g. with growing the share of R&D expenditure contributed by the private sector a good example of a long-term policy goal) and then the funding criteria should be reviewed against the purpose at regular intervals, to ensure that they are leading to the selection of the best projects. For example, we argue that the Smart Ideas scheme no longer addresses the concerns it was designed for; many of the best ideas (according to the criteria) would now face significantly better prospects of private investment (i.e. venture capital funding of a start-up) than they would have even five years ago. Arguably, such proposals would be more likely to achieve economic impact through rapid commercialisation, yet they are also prioritised for Smart Ideas funding. Revisiting the purpose of the scheme in the context of other resources and deficits in the system would suggest that support might now be redirected to more basic/stretchy research (i.e., with a comparatively higher weighting on research excellence than economic impact), as well as further along the translation pipeline – addressing issues of scale faced by our emerging deep-tech start-up ecosystem. The need for Pilot Plants, for example, is discussed under Research Infrastructure.
- One of the biggest issues that affects individual researchers and industry access, and creates perverse incentives in the sector, is the level of institutional overheads. We fully appreciate the need for this institutional funding, but would argue that it could be removed from individual research budgets and simply agreed directly with institutions on the basis of their total contestably awarded income – in effect, moved towards a quasi-core funding status. This would also address disincentives for collaboration with industry – the MacDiarmid Institute effectively subsidises the start of such relationships, to counteract existing barriers.

Core funding

- Core funding provides both stability to the scientific workforce and flexibility: individual researchers can only pivot to address new research priorities, for example, when their employment allows them the time and resource to invest time developing new skills and collaborations.
- Core funding needs to be used to incentivise behaviour by institutions. However it is often the most non-transparent part of our funding system, and so should be tied to specific forms of structural change needed of our institutions. We fully support tying core funding to ambitious equity goals.
- A current perversion of the core funding system in the University sector is the core education funding that subsidises the universities to support PhD students, while postdoctoral fellows are on fully overheaded salaries. We would argue that this combination has perversely led to PhD stipends remaining far too low as the universities are far too keen to insist on the student status of our colleagues performing PhD-level research, while postdoctoral positions are not merely scarce, but inequitably supported – a candidate can need significant advocacy from a mentor to be allowed to apply for a contestable postdoctoral fellowship, or a Marsden Fast-Start, for example, as salaries need to be supported with significant investment from departments. See our section on '*The Research Workforce'* for more detail.
- Core funding needs to explicitly include baseline resource that supports industry access to R&D within public research facilities. Currently local and international companies see a major cost disincentive to use public research facilities due to the anomaly of these charging "overheads", which in other countries are simply built into a market related cost. While it is reasonable to charge any marginal increase in expenses related to a project to an industry client it is not reasonable to duplicate charging for all costs that have already been covered by government funding (whether this is contestable or baselined).

Commercial or Industry Funding

- We recommend a clear set of funding schemes that build commercial opportunities on fundamental or applied research which could take the form of a subset of Endeavour funding, an extension of Kiwinet funding or a new fund entirely that is explicitly based on translating research into larger scale companies.
- The research funding system has generated a false dichotomy of public good vs commercial research being in competition or even mutually exclusive which does not stand up to scrutiny. They can and should each stimulate one another, while drawing talent (employees) in a virtuous cycle (e.g. vaccine research is led by industry needs in close collaboration with researchers). They cannot (or should not be able to) compete for funding by the same criteria (e.g. stretch science is unlikely to have near-term commercial use).
- Current support for start-up companies focuses predominantly on the software industry. Companies that are developing highly complex deep tech products, processes and services are not sufficiently supported to develop to an industrial scale. While New Zealand has the research talent to develop world-leading sustainable technologies (e.g. Mint Innovation, Avertana, Hotlime Labs) this sector needs further support to develop the wraparound engineering, commercial, manufacturing and other skills to set up the pioneer companies envisaged by the Productivity Commission's recent report (our submission to that process is also available).

Te Tiriti, Mātauranga Māori, and Māori Aspirations

"The door was shut. Now it is ajar"

The above statement, a quote from one of our Māori researchers, captures the perspective of Māori researchers in the physical sciences well. We want to put this perspective at the centre of our comments here, as we are well aware that pushback on equity goals can be very strong from those whose historical privilege is challenged. The door needs to be fully opened.

We strongly welcome the central role of Te Tiriti in Te Ara Paerangi, and note that the issues raised intersect strongly with many others. Coming back to our key point about the need for workforce support to be the starting point for implementation, we will reiterate that capacity is a crucial concern for the community – Māori researchers are both scarce and in-demand to respond to government signals. Any strategy needs to come from a position of support for these researchers, rather than expectation.

Direct engagement with Māori communities, to support their aspirations related to science, is in our experience a resource intensive but immensely rewarding part of Vision Mātauranga that is often inaccessible to individual researchers. Our partnership with Whakarewarewa Village, first established in 2018, has provided an invaluable educational platform through which to upskill our research community in necessary cultural awareness.

We recommend continued support of capacity development initiatives (and would point to the Science for Technological Innovation Challenge as having developed relationships and processes that do this well). We note that while not all equity matters are pipeline issues, the participation of Māori in science is very clearly connected to under-participation in scientific subjects in schools, and that this starts very early.

The MacDiarmid Institute has a long-held strategy of operating an outreach and education programme in tandem with our commercialization and industry engagement programme. By this we mean that every start-up created by one of our researchers, and every job in industry taken up by our alumni is evidence we can leverage through outreach to change the perception of what careers a degree in science can make accessible – whether that is about environmental or economic impact. We would recommend that efforts to establish a Te Tiriti-led research sector engage strongly with the education sector to make the necessary changes across the board. We note that equity strategies need to avoid being deficit-model based: thus, perhaps counterintuitively, we would argue that making te reo Māori an essential part of the school curriculum might be one of the best ways to improve the pipeline of Māori in science, by challenging dominant pākehā perspectives. As noted above it has been our efforts to improve the cultural awareness of our own researchers that we feel has paid the greatest dividends.

The Research Workforce

As a TEC funded Centre of Research Excellence, our strategy is to deliver impact to New Zealand *through* the graduates we train. We do this in manifold ways – through the brain gain of our international students who stay post-PhD, in particular joining the start-up sector – and more and more, we provide training that puts the social and economic value to New Zealand of a highly trained workforce in the foreground.

Our programme is a Career and Relevant to Industry Skills Programme (CRISP), which involves workshop-based education on career skills. Students can sign up for perhaps 10 days of instruction on selected topics over the course of 2 years of their PhD. This course is:

- Light touch, with the aim of providing insights into careers and provide key skills without a large investment of time and money. This is something we would flag strongly: the work of a PhD does not allow time for the candidate to engage in all forms of career development, but exposure to key possibilities can enable students to access additional training post-PhD as needed (e.g. our Internship programme and Alumni Business Scholarships address these cases).

- Delivered by excellent facilitators, often practitioners – our network enables us to draw on these at minimal cost, often using existing course offerings.
- Targeted for our cohort in terms of content, level of delivery, focus on useful skills development, and workshop-based pedagogy.
- Informal – there is no credential, but participation is attested to by the Institute and is suitable to record on a CV.

CRISP, launched in 2021, formalises what we have been doing in a more *ad hoc* way over the history of the Institute.

Some key bottlenecks (opportunities for reform) for training and careers:

- Increase availability of Callaghan Innovation grants e.g. to smaller companies, international students, and drop requirement to identify a person prior to application.
- Reform graduate student immigration – Visa requirements (formal and logistical) very often stop our students from overseas from participating in NZ post-graduation.
- Align career development with opportunities emerging through TTO activities i.e. in the start-up space, availability of talent is increasingly cited as a bottleneck.
- Provide postdoctoral opportunities that develop leadership skills and independence, particularly to support translation of this skill base to the private sector.

The gap between the PhD and postdoctoral experience outlined under *Funding* (above) is something we have very successfully addressed in recent years, through funded internships immediately post-PhD submission that provide experience of non-academic careers in key sectors. This addresses a key funding gap that may result in graduates choosing sub-optimal career pathways due to pressing financial constraints.

A key opportunity for government would be to extend such postdoctoral support, targeting PhD graduates with their own research ideas that might lead into the start-up sector or established industry, but for which the job opportunity requires a small lead time and targeted research in order to come into being. Much of the discussion of postdoctoral funding schemes has, in our opinion, unhealthily focused on academic careers – leading to pushback from institutions who do not have the capacity to hire all interested postdocs. However, the cultural shift we have recently seen, with PhD graduates keen to develop non-academic careers but needing time to network and develop skills post-PhD, suggests that this should not at all be a concern. The biggest waste we see in the system is that the few postdoctoral positions that exist are often allocated inefficiently, due to timing constraints on grant funding for example, and the great benefit of a small additional training period for many excellent researchers is lost.

In short, we recommend

- that the research sector establish a minimum PhD stipend to be paid by all PhD granting institutions, with the recent announcement of $35,000/annum by the Marsden Fund as a starting point, but with periodic adjustments for inflation built in. For example, government-funded scholarships in the early 2000s (the TEC managed Top Achiever Doctoral Scholarship programme), which were paid directly to PhD candidates rather than set by institutions, would be $48,000/annum in today's money; institutions have been underpaying PhD researchers for many years and we therefore believe that setting the stipend appropriately must be the responsibility of the research funder. Bringing back a nationally managed PhD scheme would be one way to do this, but the priority is insisting on minimum standards in the sector. Spreading the funding across a greater number of researchers to maximise University PBRF income or other measures of impact should not provide an incentive to keep stipends dangerously low;
- that a nationally contestable postdoctoral fund be created to support all areas of research, to be assessed on the quality of the research idea, its potential for impact, and the track record

of the candidate, to ensure that valuable research ideas are not lost to precarity. We count at least ten former FRST-funded postdocs amongst our current cohort of Investigators, including two of our Directorship team;

- that a reformed government research sector should include similar mechanisms for tying funding to specific researchers and research groups. For example, the establishment by the former CRI Industrial Research Limited of its Industry and Outreach Fellowships in 2011 has had significant influence on the ability of the recipients (namely Shaun Hendy and Juliet Gerrard) to contribute to public good science and policy since.

We also note that the focus on individuals allows for equity to be built into such schemes from first-principles; for example, with a specific stream of Māori-led postdoctoral projects within a larger scheme.

We would also like to point to the importance of technical support staff in enabling research. This is especially critical in enabling the operation of key infrastructure, to be discussed further below, and such expertise is an often undervalued contributor to research excellence and impact.

National Research Infrastructure

As a national scale collaboration, we have worked for many years to provide access to key equipment, and to support our community of researchers to collectively make cross-institutional cases for the purchase of key research equipment, avoiding duplication.

University Capex financial models, allocation of depreciation, provision of maintenance and technical support are all critical aspects. NeSI is one example of national infrastructure that has been set up with technical support at the heart of its operation and has been strongly supported by the community as a result. We would argue that the support of specialist research staff is a key element of a healthy research sector, and one that is largely made invisible by funding mechanisms.

Through consulting with science and industry stakeholders we have identified a gap in the start-up ecosystem: a lack of support for pilot and demonstration scale-up development, that disproportionately affects deep tech start-ups. Deep tech start-ups contribute to Aotearoa New Zealand beyond direct economic benefits by developing our economic complexity and resilience, including our ability to respond to the threats and opportunities arising from issues of sustainability and climate change. However, deep tech enterprises face additional challenges of complexity, risk and costs beyond the level of those faced by software (SaaS) start-ups. Also, the potential industry partners and investors for many of these complex commercialisation projects require any new technology to be demonstrated at scale before adopting them.

Further detail can be provided as per our existing discussion document, but in summary, the major areas of support needed to enhance New Zealand's success in commercialising emerging materials science related deep tech companies include the following:

1. New non-dilutive funding stream for complex deep tech start-ups that is contestable and specifically aimed at funding capital intensive pilot and demonstration plants.
2. Technical capability (highly skilled people) with the mandate to support development of the plants, and a streamlined and transparent process for accessing them.
3. Support to navigate regulatory barriers to pilot and demonstration plant development (RMA, EPA, HSNO, quality standards and GMP certifications etc).
4. Physical spaces set up for pilot plant development in a "plug and play" manner, ideally with regulatory and RMA settings already in place.

Industry access to facilities and equipment (includes centralized procurement of new facilities)

Where capital intensive and operationally expensive equipment is useful for industry R&D and is best housed in research facilities (e.g. genomics facilities), we recommend that both the procurement and ongoing management of this equipment be approached as an "Infrastructure as a Service" type model.

In many cases it is possible for a lead institution to develop a business case to host the equipment and provide access to its own and external researchers; an important aspect of such a business case is to allow and charge for external access. Where this is undertaken transparently and access is costed on a cost recovery basis (not as a profit centre), then such infrastructure is likely to be more efficiently accessed by both research and industry users. Such a model does require a strong commitment to collaboration as well as robust planning of operational resourcing (staff to keep facility running and accessible to external groups vs a single researcher and their students knowing how to run the equipment).

We would note that keeping up to date databases of equipment is a difficult and important task, that we are aware is currently being duplicated somewhat by the NZ Product Accelerator and MBIE.

Conclusion

We appreciate the time being taken to consult with the research community, and as noted above, would welcome any opportunity to discuss any of these ideas or comments further if additional detail would be useful.

Nāku noa, nā

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