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Te Ara Paerangi - Future Pathways submission from Paihau - Robinson Research Institute

Introduction

Paihau - Robinson Research Institute has its origins in the Physics and Engineering Laboratory of DSIR, and evolved as a team within Industrial Research Ltd (IRL) 1992-2012, Callaghan Innovation 2012-2014 and Victoria University of Wellington 2014 to the present. We have deep connections to researchers and industry across New Zealand and internationally in the high value manufacturing sector. In this submission our responses reflect our experiences within this sector.

Our key points

- We are supportive of moving to a base grant model. However, there are forces at work which limit the flexibility of research workforces and programmes which won't be changed by a base grant model. For example, any research programme creates an internal and external constituency who are happy to see the programme continue. The researchers develop expertise that fits the programme and stakeholders become invested in the outputs.
- Science leadership is therefore extremely important as a catalyst for change within research organisations. Leadership and decision-making needs to be grounded in expertise, experience and fundamental scientific knowledge. This is a precondition to ensure impactful frontier research is prioritised by the system. It is common among most overseas systems that the leadership positions within national science organisations, and government funding bodies, are held by scientists who are established experts in their field.
- We understand the desire for stability of careers and greater collaboration across the system, however instability and competition shouldn't be seen solely as negatives to be eliminated. A dynamic, responsive system needs forces which push renewal and change. These will sometimes be uncomfortable, but such forces need to be designed into the system.
- Likewise, redundancy, duplication and slack should not be seen solely as negatives. A system without redundancy and slack is unlikely to be resilient and agile.

Detailed responses

KEY QUESTION 1: What principles could be used to determine the scope and focus of research Priorities?

Our view is that Priorities could have a different character in different areas. Principles for setting the scope and focus could include:

- The potential impact expected from a successful programme. This may be economic or social or environmental
- The likelihood of success. This includes the likelihood of significant technical advances, and the ability to absorb or implement the knowledge in a useful way.

- The presence of existing scientific leadership in the area. (Arguably if an area is important enough then recruiting leadership should be an initial step).
- Appropriate scale: traditionally NZ does not invest at scale in new technologies. Compare for example the Australian effort in Quantum computing or Denmark in fuel cells. This is probably rational behaviour as NZ is unable to guarantee the concentration of resources required to assure a technology developed here, stays here. The exception is if we can assure the end user benefits to NZ, e.g. geothermal or use of NZ mineral resources.
- Decision making: is best made by diverse groups. An intrinsic weakness in NZ is that any one science area has a small group of experts. Thought should be given to how we can better use international expertise to review and enhance our programmes.
- Support the national 'scientific commons' in such a way as to allow challenge and refresh to the scientific thinking in the country so that the approaches to priorities do not become stale or locked in unproductive programmes.

KEY QUESTION 2:
A) What principles should guide a national research Priority-setting process?
B) How can this process best give effect to Te Tiriti?

- Accountability should rest with the ministry or an appointed body for the overall portfolio of research priorities
- We agree that strong research leadership is an underappreciated key success factor. The best governance arrangement would be a small advisory board supporting the PI or science leader. The science leader should also have adequate administrative support.
- Our experience has been that CRI corporate style management adds little to achieving science impact and is not value for money. The role of CRI management structures needs to be reviewed.
- To give effect to Te Tiriti requires stronger Māori participation at the governance level and throughout the priority setting process.

KEY QUESTION 3: How should the strategy for each research Priority be set and how do we operationalise and implement them?

We do not assume the same approach to setting strategy would work for each priority. For example, a long-standing priority has been the growth of high value manufacturing in NZ, but this sector is disaggregated, and it is much more difficult to craft a strategy for broad impact than say the health or agricultural sectors. Arguably the demise of Industrial Research Ltd was due to its inability to articulate and implement a consistent strategy to grow manufacturing and related sectors.

We would make the following observations for strategy and implementation in a disaggregated sector such as high value manufacturing.

- Research priorities in HVMS or related sectors such as energy should stay high level. The current SSIF-AETP programmes are a good model.
- Having a range of research providers engage with this sector makes sense rather than trying to have one dominant institution.
- A diverse range of support for commercialisation is also appropriate in this sector. The Kiwinet and Return on Science processes are excellent and provide the connection to the VC community.
- Development times for physical technology can be very long, therefore investing in 'platforms' as per the SSIF-AETP type programmes, with an implied long-term commitment to a technology area is welcome.
- SSIF platforms or similar provide an appropriate funding mechanism for mission led research.

- Competitive funding mechanisms such as the current Endeavour Programmes can provide a balance of addressing government priorities and investigator led research. Implicitly there is already weight given to priorities across economic and environmental sectors in funding these programmes.
- Funding such as the MBIE Endeavour 'Smart Ideas' and the Marsden fund provide a balance of investigator led research. There should always be such funds available to complement mission-led funds.
- We agree with the MBIE emphasis on excellence, impact and international collaboration in judging the research to support.
- Insisting that research programmes have industry co-funding can sometimes backfire. It can tie researchers in to IP agreements early in development with the wrong long-term partners. It can also force researchers to mould programmes to address the needs of partners who are contributing small amounts of money in comparison to government funds.

KEY QUESTION 4: How would you like to be engaged?
N/A

KEY QUESTION 5: What are your thoughts on how to enable and protect mātauranga Māori in the research system?

- We are very supportive of raising the stature of mātauranga Māori. To give effect to this we support…
    - Direct funding for mātauranga Māori
    - Increased representation for Māori in governance roles
    - Outreach and engagement with rangatahi
    - Retention and support for Māori researchers
    - Long term partnerships between iwi groups and research groups.
    - Efforts to improve cultural literacy for non- Māori

KEY QUESTION 6: What are your thoughts on regionally based Māori knowledge hubs?
We think it is important to get Māori input on whether regionally based centres are what they want. In our discussions with iwi they are certainly ambitious to establish their own research capability. The weakness with regional centres (and this applies to any regional centre) is overcoming the lack of connectedness to a broader research capability. It is harder to establish and maintain a high standard of research in a small group. Building off Wānanga may be a starting point.

KEY QUESTION 7: How should we determine what constitutes a core function and how should core functions be funded?

- We agree core functions should have some dedicated funding.
- We have no special insight into how to determine what is a core function. We note that a list of critical research could easily expand to be a large one. For example, is climate change mitigation now critical? Cybersecurity is certainly critical – but how much cybersecurity research should we do? We can only say that a decision-making process is needed which considers the value of this research compared with other priorities.
- A key consideration should be whether open competition for some or all funds in a critical research area would lead to better outcomes.

KEY QUESTION 8: Do you think a base grant funding model will improve stability and resilience for research organisations, and how should we go about designing and implementing such a funding model?

- We agree base funding would give research organisations a greater ability to set and follow through on strategic priorities.
- We will defer to others on the best model, but there are many international examples to learn from.
- The base funding model would 'tamp down' competition, but with positive and negative outcomes. In the negative sense the ability of new entrants to a research area to out-compete a complacent established group would be lessened.
- Essentially a new entrant can't grow too fast as it won't have the funding for infrastructure. This would have affected Robinson directly in recent history. We have leased extra laboratory space but can only pay for the outfitting and lease because our grants have overhead. If this was not the case, we would have required the university to have covered the overhead in the short term until a longer-term renegotiation of overheads could take place.

KEY QUESTION 9: How do we design collaborative, adaptive and agile research institutions that will serve our current and future needs?

- Do not have too many layers of management who can thwart change. Robinson has been able to adapt and change much faster as a university-based research institute than we were as part of IRL. One reason is because the Director (equivalent to one level below a GM in a CRI) is effectively the final decision maker on proposals and contracts.
- Balance productive and unproductive competition. There is a degree of talk in the Green paper about 'unproductive competition' and emphasis on collaboration, but this needs to be balanced with the productive side of competition. The system needs to encourage the continuous generation of new ideas from which the best are funded. There should be minimal barriers to scientists writing proposals and having a chance at getting them funded. This can be done within the context of research priorities if scientists understand what outcomes are wanted.
- The ability to pivot (be agile) depends on the latency in the system, that is, the built-in delays encountered in changing direction or growing. For example, at both Kelburn (VUW) and Gracefield (CI) campuses there is no laboratory space available for lease. To expand or start a new research programme, without closing an existing one, we must find new accommodation or wait for it to be built. Building can take years. To that extent, having some 'not at capacity' lab space available at these locations should not be considered wasted duplication, but rather essential growth space that should always be available.
- The Green paper speaks about improving efficiency by removing redundancy (duplication) and better utilisation of resources. But system efficiency and resilience often demands increased redundancy and underutilisation of resources. In our view this is a natural tension which requires balance. (The current supply chain issues both locally and world-wide as this is written in the middle of the Covid Omicron outbreak, speak to this issue).
- Having 'technology parks' integrated with CRI's or university sites can increase agility in property use. If CRI's or University's don't require the space, it can be leased to companies. If the research demands increase, then the property can be pulled back from commercial use. This has happened in the past at the Gracefield site, but the model has now failed due to the lack of renewal of buildings.

KEY QUESTION 10: How can institutions be designed to better support capability, skills and workforce development?

- At Robinson we have been more successful in attracting international talent since becoming part of the university. We think this is because the university is perceived as offering more flexibility and autonomy to researchers. Universities also have education as part of their core mission, so supervising PhD students and educational activities in general are perceived in a more positive light which is attractive to many researchers.
- Although there are instances where mobility across institutions is very beneficial, this is more likely in those who are seeking management and commercialisation roles. Moving core researchers from institution to institution is not a useful goal. Researchers should be able to collaborate across institutions and develop their careers without needing to move.
- Co-appointments to institutions can also be counterproductive as researchers have to accommodate dual administrative processes.
- The exception would be researchers who want to move to the private sector. Secondments and similar arrangements can already be negotiated for this.
- Having a suitable hierarchy of research grants, from small internal grants, through Marsden, Endeavour and SSIF, provides a framework for researchers to gain experience for successively larger programmes. Maintaining this hierarchy is important for workforce development.

KEY QUESTION 11: How should we make decisions on large property and capital investments under a more coordinated approach?

- There is value in co-location. In general, fewer, larger campuses for science would allow for better utilisation. If these sites also had 'technology park' type accommodation available for spin-offs and the private sector this would further increase flexibility.
- Our experience has been that CRIs are unable to make timely investments in new property and in the case of IRL they were unable to properly maintain their property portfolio. IRL didn't have the cash to fix leaking roofs, it was that crazy.
- The financial model of CRIs needs to be such that they are incentivised to invest appropriately in property and infrastructure.
- Wanting more coordination should not be an excuse for failing to fix problems in a timely way. The losses from delayed investments and maintenance within the CRIs could likely outweigh any benefits of coordination. As soon as multiple organisations are required to agree on a course of action there is the risk of nothing happening.
- The significant problems we have seen aren't co-ordination problems, they are poor decision making or no-decision making. We would cite the Gracefield Innovation Quarter as an example. This should already have been redeveloped with quality buildings for existing tenants and enough new buildings for a 'Technology Park' ecosystem to develop. Not having this done is reducing the productivity of the science system now.

KEY QUESTION 12: How do we design Tiriti-enabled institutions?

- This is beyond our expertise, but here is what we are doing.
    - We have a Māori voice on our Advisory board
    - We maintain close relationships with the office of Deputy Vice-Chancellor Maori.
    - Are active in outreach activities.
    - Active in building long term partnerships with iwi.
    - We exhibit pride in our Māori staff and students by highlighting their stories where appropriate.

KEY QUESTION 13: How do we better support knowledge exchange and impact generation?

What should be the role of research institutions in transferring knowledge into operational environments and technologies?

- Different domains of research have different needs related to how impact is created.
- In technology development the ability to patent or otherwise protect IP is crucial for attracting the private investment then necessary for commercialisation.
- The university has a flexible policy on IP beneficial ownership, but with an incentive for researchers to create and commercialise IP.
- CRIs have generally not incentivised individual researchers to create IP through offering beneficial ownership of IP. IRL looked at this issue multiple times but never instituted a policy to give a beneficial IP ownership to staff. I can see this creates problems at the local level as technology development often involves teams of people with varying and ill-defined levels of involvement. This means there is a difference in how university and CRI researchers are treated. Our preference is for the university model but with an awareness of the problems that could ensue.
- Past Ministry policy has sometimes been destructive of IP value. This has been through forcing institutions into partnerships with weak commercial partners. Thankfully this is less the case currently.
- IP strategy should be set at the programme/project level. There is no one-size-fits-all model.
- A channel for communication between the funding bodies and the Technology transfer offices (TTO's) could be useful so both are learning from what works and what doesn't.
- The best international IP policies set by funders are designed to ensure IP generated can be commercialised. That is, it isn't possible for any party to the research programme to unreasonably restrict access to the IP needed for commercialisation. IP plans for MBIE programmes can be written now with this intention.
- In the past government funding of research in NZ has if anything paid too much attention to existing firms and sectors. This has needlessly limited the ambitions of researchers.
- The model for University research institutes of being supported by a TTO generally works well. CRIs having their own business units for commercialisation/engagement is appropriate.
- We don't see much value in co-ordinating this activity across CRIs, on the other hand creating opportunities to share learning is useful.

KEY QUESTION 14: How should we include workforce considerations in the design of national research Priorities?

- The international model for science careers is a tournament structure (as it is for many high performance, high skill occupations). That is, the numbers progressing at each stage are a subset of those at the previous level. A tournament (or pyramid) structure is a necessity. Having too narrow a base of school leavers and BSc/BEng in STEM would be of national concern for many reasons, as technical skills are required across our economy. Further along, many PhD graduates have found after 3 years that they don't want a career in research, or their supervisors have found they are ill-suited for one!
- The number of PhD scholarships and post-doc appointments should be managed so that the pyramid does not become a Ponzi scheme. By this we mean a process where an unacceptable number of participants are destined to be disappointed as they cannot progress or succeed.
- Publishing papers is not anti-correlated with impact or leadership although it is not a direct correlation either. We appreciate the concern that publication metrics or other traditional academic measures can become overemphasised in the system. The system must have enough embedded

wisdom not to be gamed. Our experience is that current funding mechanisms do well at this balance.

- We are not sure better leadership development can be affected much by the design of national research priorities. This is more about the culture of institutions. It also depends on a hierarchy of opportunities for research leadership provided by the funding system.
- We agree leadership is not developed as well as it should. Most institutions have some leadership development and career development programmes. These are worthy of support and enhancement.

KEY QUESTION 15: What impact would a base grant have on the research workforce?

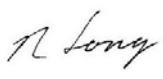
- The overall effect should be to reduce precarity.
- Whether it Increases diversity or career pathways depends on the behaviour of the institution. Having greater assurance of income should make it less risk to hire someone who may take extended parental leave for example.

KEY QUESTION 16: How do we design new funding mechanisms that strongly focus on workforce outcomes?

- This is connected to the earlier comments on the tournament/pyramid nature of the research career. We think NZ should work hard to attract the best possible researchers into the careers we have available. This is a banality – why wouldn't we? However, particularly within mission-oriented work, we can't all be leaders, all the time. We also need team players and role players to get the work done. The expectation that every post-doc will become a research leader with their own programme is unrealistic.
- The Rutherford Discovery Fellowship scheme is great for attracting top quality applicants. It is less good at promoting areas where NZ has a strategic need. We recommend that some weight be given to national research priorities when selecting these Fellows.
- Additional post-doc funding should only be added if there is an understanding that this part of the 'pyramid' needs to be widened. Otherwise we are creating the 'Ponzi scheme' referred to earlier.

KEY QUESTION 17: How do we support sustainable, efficient and enabling investment in research infrastructure?

- We observe that some efforts to centrally fund infrastructure have been successful and stable and others less so. Technological change, or change in research priorities, will sometimes undermine existing arrangements and this needs to be acknowledged and adjustments made.
- We suggest accepting that the structures around infrastructure may appear rickety and have to be adjusted as circumstances change.



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