



FEEDBACK on FUTURE PATH and INNOVATION

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A view from industry:

This feedback is a contribution to the discussion on the Future Path document. It is based on a personal experience in start-up companies. I am presently in my fourth start-up company in NZ and Australia and am the Founder, Director and CEO of NZeno Limited.

NZeno is a start-up Biotech based in NZ that has a **medical grade pig business** based on:

- i. Supplying medical grade tissue to a company in Australia
- ii. Licensing our pig strain for development of gene edited pig heart for human xenotransplantation
- iii. Developing gene edited pig kidneys for human xenotransplantation as our lead product to meet the enormous medical need and market in kidney failure. End-Stage kidney disease disproportionately affects our Māori and Pacific Island community.

This feed-back reflects past experience, including:

- i. Collaborations with University of Otago, Auckland University of Technology, University of Auckland, Australian National University, Ludwig Maximillian Universität in Munich, Crown Research Institute (CRI) – AgResearch and Auckland City Hospital
- ii. Support from Callaghan Innovation; MBIE Endeavour grant to AgResearch
- iii. Engagement with Ngāi Tahu (Southland)

Industry expectation of public research institutes

EXPECTATION: No company has all the technical expertise necessary to develop its research product. NZeno looks to external organizations, private technology service companies, universities and research institutes internationally for expertise and capability.

For example:

- i. Full genome sequencing was carried out in South Korea with bioinformatic analytical interpretations provided by Australian National University and University of Auckland
- ii. Gene editing carried out by AgResearch for a service fee.
- iii. Cloning and embryo transfer in pigs at AgResearch with MBIE Endeavour grant
- iv. Development of a unique organ transport media by licensing-in intellectual property from the University of Otago.

The criteria for collaboration or service contracts are based on expertise, service quality and cost.

FEEDBACK on form, governance, structure and workforce:

- i. **All CRI scientists to be affiliated to universities for their research:** Research scientists from CRIs become affiliates of universities to continually develop themselves as scientists with the aspiration of being recognized as experts competitive in their field as demonstrated by their publications in academic and industry (applied research) journals and by creating new intellectual property (IP).

- ii. **CRI are dissolved as separate entities and absorbed into universities as Graduate Schools of Applied Sciences** such as for the Life Sciences (human, animal, plant, marine, food); Climate & Environmental Science; Computing, Artificial Intelligence and Cybernetics; Robotics and Engineering; Nanoscience, etc. and run on a separate budget that does not cover undergraduate teaching.

Scientists in their original clusters or re-distributing themselves to a university school of applied sciences may or may not participate in post-graduate teaching. The school provides experience for graduate students and scientists to participate in industry countering criticism that universities do not equip their graduates for industry, (which does not exclude some scientists being leaders in blue sky academic research).

- iii. **Scientists in Graduate Schools of Applied Sciences are funded for solving problems relevant to industry.** Mechanisms for funding and career development are needed:
 - a) Base funding for scientists supported with components for teaching or advanced research or industry
 - b) Scientists allowed to be co-opted to industry for a specific project under a grant for institute-industry project based on excellence for creating new knowledge and IP.
 - c) The scientist co-opted for an industry project for a period of time would not lose their seniority and salary status when returning to the institute.
- iv. **Institute-industry funding offsets high overheads for Start-Ups:** For innovative start-up companies the university and CRI overhead costs are often prohibitive compared to service contracts with external private companies. The Applied Science institute should have a base fund that offsets high overhead costs. They receive competitive public grants for research, grants for projects that are not yet ready for commercialization, and fees for service from industry for later stage projects.
- v. **Funding policy to include selected and interdisciplinary fields:** Industry seeks expertise in specific platforms such as gene technology, bioinformatics, digital technology, artificial intelligence. However, many industry projects are multidisciplinary. For commercial success, the selection criteria should encourage interdisciplinary R&D.
- vi. **Funding policy to include international collaborations:** The isolation of New Zealand has some advantages in approaching problems in a unique way. Nevertheless, international connections are essential sources of expertise that our scientists must access. A proportion of funding should be for projects with international partnerships.

Callaghan Innovation and NZ Growth Capital Partners

NZeno has grown from a start-up project to a company with revenue from the first export of medical grade pig tissue. This field has recently received attention with the FDA approval of gene edited pig tissue for food and human therapeutics.

EXPECTATION FROM EXPERIENCE: NZeno would not have survived the early stage or the covid epidemic were it not for support from Callaghan Innovation:

- i. Project grants in industry contribute to new knowledge, similar to grants to academia but may take a longer time to publication. Publications from NZeno scientists (previously at Living Cell Technologies) are well cited.
- ii. Project grants, in addition, develop commercial value for a New Zealand based industry.
- iii. Project grants attract investments: NZeno has received \$635,242 in grants and raised \$3,484,200 for equity in the company from investors, local and international – the experience of other companies too.
- iv. R&D Loan: Without the R&D loan and Wage Subsidy, NZeno would have closed or been completely sold to a foreign entity following the second Covid pandemic wave in 2021. Callaghan Innovation supported the Covid Wage Subsidy for pre-revenue companies.
- v. Equity in NZeno held by NZVIF/NZGCP: This could be much larger for the business to grow more rapidly

FEEDBACK on robust structures for public-private benefit from research

- i. **Encourage private (including international) investments with project grants to start-ups.** In R&D, development (D) generally costs more than initial research (R). Nevertheless, Callaghan project grants are relatively small investments. Despite this, Callaghan research grants have always ‘attracted’ investments into the recipient company of greater than 5 times the project grant amount. *This is a significant way to encourage more private investments in industry in NZ, partly because this funding is non-dilutive of company shares at a critical early stage.* Funding for innovative start-ups is to be distinct from incentives to encourage growth of established companies. Project grants, R&D Loans and Research Tax incentives decrease the risk that private investors face with innovation research as distinct from investments for business or market growth. These incentives attract capital investments from international venture funds, which ultimately can help with a faster scale-up and commercialisation of research.
- ii. **Research development fund needs to be significant and target innovation**
 - a) Funding from NZGCP has been helpful as funds of funds but have remained too small to significantly impact the national economy.
 - b) Picking winners is not possible (A2 Milk, the Weka film industry, Xero or Rocket Lab were not foreseen to be guaranteed of success at their early stage). Proposals must be assessed case by case.
 - c) Venture funds in NZ are risk averse and less innovative. There is still limited funding for the post start-up to Series A stage of innovation projects. Importantly, for a proportion of the fund – 20% perhaps, policies may set the criteria for high-risk proposals which have significant estimated potential commercial returns.
- iii. **NZGCP as co-developers of innovation projects with industry for more significant public co-ownership of new companies.** Note: UK’s new Advanced Research Innovation Agency (ARIA-The Economist February 12, 2022) and DARPA in the US.
 - a) Develop a major role for Callaghan (early stage) and NZGCP (later but pre-IPO stage when most wealth creation happens) to capture benefits of innovative research for public co-ownership.
 - b) The challenge is for this fund to be managed without political bias and bureaucracy (and therefore being in place for the long-term). It should also be directed into

innovation that has a risk component. Public-private co-development lowers and manages the risk that is integral to innovation.

- c) Partnership co-funding, with investment funds held by some iwi, ensures the participation of Māori in areas of significance to Māori and ultimately Māori co-ownership in innovative companies

SUMMARY FEEDBACK:

CO-DEVELOPING INNOVATION TO BENEFIT PUBLIC AND PRIVATE INVESTMENT

STRUCTURE

1. CRIs to be re-structured as university Graduate Schools of Applied Sciences to emphasize that the institutes are focused on major problems faced by industry and society.

WORKFORCE

1. All CRI scientists to be affiliated to a University Graduate School of Applied Sciences that facilitate their scholarship as competitive experts in their field as demonstrated by their contribution to publications in academic and industry journals, patents, services to industry.
2. Scientists are to be funded with institute-industry grants benefitting the graduate school and industry. Grants are to have a proportion requiring participation of international expertise. Employment contracts for scientists should not disadvantage those co-opted for industry.

FORM OF FUNDING FOR PUBLIC-PRIVATE CO-DEVELOPMENT, CO-FUNDING AND CO-OWNERSHIP

3. Encourage Private (local and international) investment with increased Callaghan Innovation project grants as they have consistently attracted more than 5-fold in private investments into recipient companies at the critical early stage.
4. Reduce risk faced by private investors in innovation research with R&D loans and Research tax incentives.
5. Government Innovation Investment Funds be scaled up for impact and target innovation. This funding focuses on post company start-up funding and enables the public funder to be co-developers of innovation at the pre-IPO stage when wealth creation most happens to become co-owners of nascent innovation companies. This increases the D in R&D. Without more development funding, New Zealand will not benefit proportionately from its research investment. Innovation investment should include the funding of high-risk projects based on criteria for innovation with potential high commercial returns. Public innovation funds would choose to profitably exit the investment in the same manner as private venture funds.

THE FUTURE PATH MUST HAVE A DESTINATION: CO-OWNERSHIP

The Future Path must not stop midway at funding early academic research. This path has to lead to a clear destination where social and commercial benefits of research are shared by private investors and the public. Mechanisms for public-private investment for *co-development, co-funding, co-risk taking and co-ownership* in R&D have to be in place as essential components of a Future Path.

Key Concepts:

Graduate Schools of Applied Sciences; Innovation Development Fund; Public-Private Co-ownership

NGĀ MIHI - END.