MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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TITLE	International models for technology research ecosystems		
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PURPOSE	To provide examples of technology research organisations and associated supporting structures and ecosystems in comparator countries		

SCIENCE SYSTEM ADVISORY GROUP

Contents

Preamble

The Science System Advisory Group (SSAG) has been asked to develop a set of recommendations to strengthen New Zealand's science, innovation and technology system and ensure its future success.

To support the SSAG in its role, the secretariat has prepared this background document on an Advanced Technology Initiative. It outlines initial thinking on the nature and role of critical functions for technological advancement in national innovation systems, and the enabling role such functions play in taking advantage of innovation as a driver of economic competitiveness. It also contains information on international comparisons of functions and a gap analysis of said functions in New Zealand's national innovation system.

This document is intended to be introductory rather than comprehensive. Different criteria for analysis of options could be considered going forward as well as other international case studies, including different options for how to embed critical functions for technological advancement in New Zealand's national innovation system.

The secretariat will be happy to provide more information and detail on these topics on request.

MBIE's policy thinking on the Advanced Technology Initiative is being provided in three distinct documents to align with the SSAG discussions:

1. Document 1: Overview of the technology research ecosystem in New Zealand
2. Document 2: International models for technology research ecosystems
3. Document 3: Potential options for an Advanced Technology Initiative

This is Document 2: International models for technology research ecosystems.

Section 1: Tech platforms, types of technologies and value chains

Technology platforms support firms at all levels of innovation potential and maturity, and they promote innovation in many sectors

1. Internationally, facilitating structures for technological advancement in the form of independent technology research institutions (e.g., Japan's AIST, Germany's FhG, Finland's VTT, and Taiwan's ITRI) support innovation in many sectors by providing, among other things, a critical mass of high-end technology research expertise focused on a sufficiently broad yet strategically chosen range of advanced 'technology platforms'.[1]

2. A platform is broadly a collaborative inter-institutional grouping of SETD (science, engineering, technology and design) capability. The Callaghan Act 2012 defines a technology platform as 'a facility that pools skills, resources, or equipment in a manner that is intended to enhance the scientific, technological, or other related capability or performance of the facility's users'.

3. Table 1 below shows three main types of technology platforms that overseas paradigm cases of technology research institutes provide to support industry:

[1] Intarakumnerd & Akira (2018), Role of Public Research Institutes in National Innovation Ecosystems in Industrialised Countries: The cases of Fraunhofer, NIST, CSIRO, AIST, and ITRI, in *Research Policy*, 47(7). https://doi.org/10.1016/j.respol.2018.04.011

Table 1. *Three main types of technology platforms*

Examples: Overseas tech research institutes	Type of technology platform
Japan (AIST)	**Business platform and intelligent technologies** The AIST provides business platform technologies that provide the foundations for building and running business applications. They allow users to run their applications smoothly without worrying about the technology that supports them. They deliver foundational components – or building blocks – needed to drive innovation and business growth: • *Business platform technologies*: analytics, database and data management, tools for application development and extension, and integration. • *Intelligent technologies*: artificial intelligence (AI), machine learning, and the Internet of Things (IoT).
Germany (FhG) **Australia (CSIRO)** **Finland (VTT)** **Japan (AIST)** **Taiwan (ITRI)** **EU (EIT)**	**Technology infrastructures** A range of paradigm cases of technology research institutes provide industry and firms with access to state-of-the-art R&D infrastructures dedicated to breakthrough and enabling technologies with broad application. These facilities help de-risk the innovation process by limiting the capital expenditure required to get a product up and running since innovators do not need to invest in their own facilities: • *Technologies as dedicated infrastructures:* access to the combined components (hardware, materials and substances) needed to operate breakthrough technologies and undertake R&D, such as: biomass processing; fibre materials; hydrometallurgy; industrial biotech infrastructure, materials performance, metrology, nano- and microelectronics; photonics; printed and flexible electronics; quantum technology infrastructure; thermochemical conversion infrastructure. • *Innovation facilities:* physical assets (research space, equipment, instruments, and other physical assets) and people (expert knowledge and/or technical skills required to make use of kit and support the research and innovation process). • *Scale up facilities:* enable industry partners to fast-track R&D and trial commercial runs, as well as expand their operations and enter new markets
Germany (FhG) **Finland (VTT)**	**Critical, Enabling and General Purpose Technologies (GPTs)** Many international technology research institutes also identify strategic research fields in technological areas critical to their nation's economy and/or in which GPTs play an important role, because they are widely applicable across the economy, change the way we go about inventing and can cause cascading innovations with inter-linked technologies for their application and other

	sectors (also known as 'innovational complementarity'). To this end, dedicated facilitating structures for technological advancement: • *Identify strategic research fields:* critical and general-purpose technologies that address needs and markets that will shape the future of society and the country, such as enabling technologies (wireless networks; artificial intelligence (AI); microelectronics and photonics; quantum technology; new materials; biotechnology) and converging technologies (energy technology, manufacturing technology, health technology, security technology, and space technology) • *Develop a significant strategic research portfolio:* pre-competitive and pre-commercial research specifically targeted towards projects with high commercial potential aligned with identified strategic fields, such as: developing wireless networks to enable radical automation; accelerating artificial intelligence; microelectronics and photonics to facilitate digital transformation; new materials to enable carbon-neutral material cycles; biotechnology to enable radical sustainable innovations; Health technology to enable proactive and effective treatment; space technology to revolutionise mobility, communication and observation.

4. A decade ago, the draft business case for a New Zealand Advanced Technology Institute (ATI) noted that platforms support firms at all levels of innovation potential and maturity, and that they achieve this through their:

   a. scale/critical mass and organisational form, which makes them visible and accessible to users and able to pull together and combine resources to meet needs;

   b. multidisciplinary and collaborative approach, which allows effective and novel combinations of knowledge and skills;

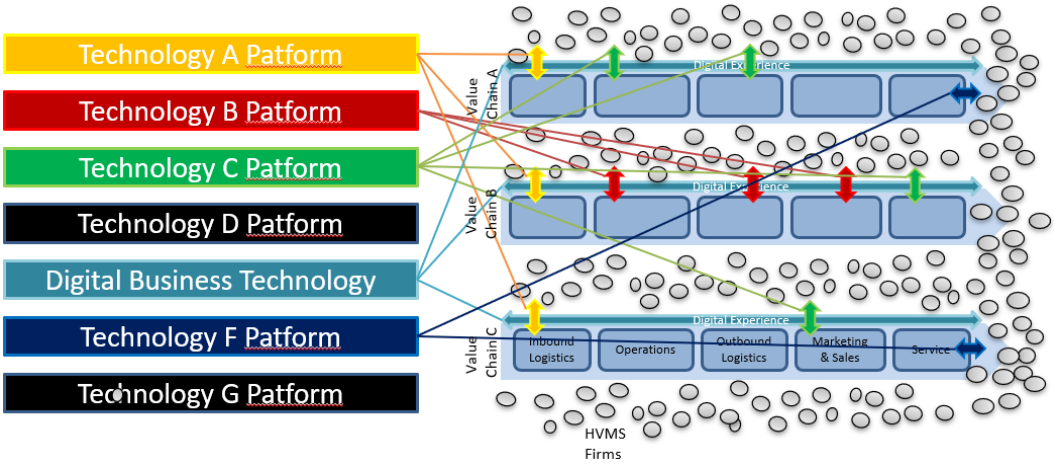
   c. strategic orientation that reflects the needs of users, looks beyond immediate problems, and supports innovation at the industry, pre-competitive level.

Platforms are based around technologies that interact with value chains in different ways

5. Platforms are based around technologies because the source of competitive advantage almost always lies in the core technology itself. The technology is also the medium through which HVMS type firms interact with value chains in different ways and they may do so across a range of sectors, as shown in Figure 1 below.

6. HMVS firms, especially SMEs with around 100 staff or less that are still young companies and have not yet assembled deep tech capability, benefit from technology platforms, because they will look to outsource high quality technical capability across a broader array of new and emerging advanced technologies that can drive innovation of their goods, services and/or processes. This ensures they can develop and maintain the competitive advantage of their specialist technology.

Figure 1. *Technology platforms interact in different ways with value chains. They may do so by either helping firms innovate a specific link of the value chain or completely transform entire value chains (for example, the turquoise **Digital Business Technology** platform shows how digital technologies are transforming the experience of value chains from beginning to end). The coloured technology platforms and arrows simply illustrate the variety of ways in which platforms may interact with one or more links of a single value chain (e.g., **red** arrows) or may add value to multiple value chains (e.g. **yellow**, **green**, and **blue** arrows).*



7. High-tech platforms are a key source of innovation for high-tech firms, and for transforming other innovative firms into high-tech firms. Economic transformation is facilitated by significantly increasing the number, diversity and the cumulative size of these high-tech platforms, and when they are linked with globally competitive firms.

Section 2: The Strategic Dimension of Critical Tech-Functions and Implications on Roles

The roles of ATOs vary internationally because they are determined by the external environments they operate in, specifically maturity of industry

8. Research institutes must constantly change their strategies according to the state of the innovation systems they operate in to be effective, including any new technologies in circulation and the demands and maturity of local industry.

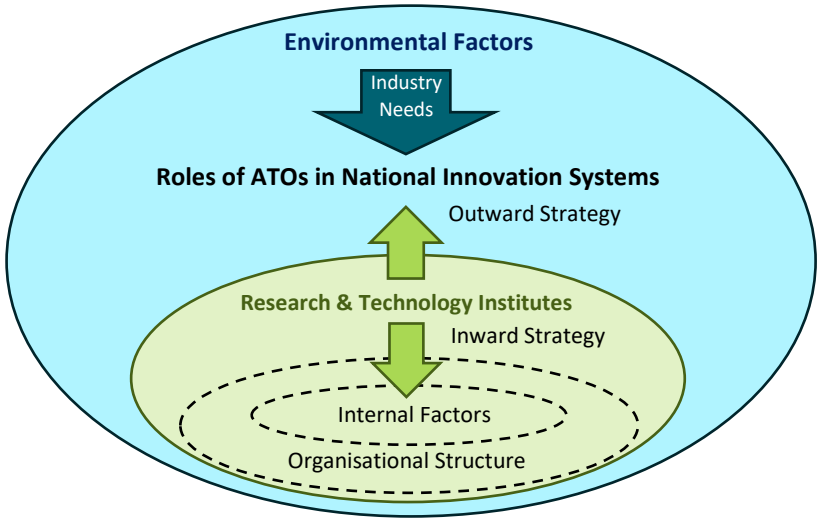
9. We observe that ATOs overseas have a history of going through distinct developmental stages with associated organisational and structural reforms to strategically reposition themselves and realign their organisational structures with developmental strategies of the nation's industry.

10. Properly positioning ATOs to be technology powerhouses to aid industry is therefore an ongoing policy issue. Figure 2 below illustrates how this dynamic process through time negotiates two main strategic considerations for ATOs:

    a. Outward strategies: the institute's approach or response to environmental factors, demands or changes.

    b. Inward strategies: the institutes approach or response to resource adjustments or organisational change.

Figure 2. *Interplay of inward and outward strategies in the evolution of the roles of technology research institutes*[2]



11. As a result of these dynamic, developmental processes, international ATOs take on similar roles (e.g., being 'industry platforms' and 'ecosystem catalysts') where their external environments compare. Their roles differ when their contexts differ, especially in relation to how they balance several roles.

12. It is not feasible for countries with developing industries to deploy ATOs with roles similar to those in advanced OECD economies due to differences in conditions.

[2] Figure 2 has been reproduced from Chen & Chen (2014) The evolution of public industry R&D institute – the case of ITRI, in *R&D Management*, 46(1), p.51. https://doi.org/10.1111/radm.12110

13. In countries with developing industries (where industry structure is characterised by most firms being small- and medium-sized enterprises) governments tend to be more active in building R&D capabilities in the industry sector. This is typically reflected in ATOs playing a bigger role in technology push and promoting technology diffusion, to increase the rate of adoption of new and emerging technologies and the creation of IP to infuse industry with new spin out companies.

14. Taiwan is an example where 97% of firms are SMEs and, therefore, lack the ability to seek technologies from foreign sources or local universities. As a result, its industry relies more heavily on its ATO to drive diffusion and adoption of new and emerging technologies, as well as inject novel ideas into industry.

15. Taiwan's ATO started with a focus on fast following to diffuse technologies to upgrade or extend existing local industries alongside firm creation. As industry matured over time, Taiwan shifted to being more innovation oriented and apply a critical mass of capability to solve industry problems, thereby assisting Taiwanese industries to generate global impact, including by taking a more 'direction seeking' role for emerging industrial opportunities.[3]

16. In contrast, countries with huge corporations (Korea) and multinational companies (Singapore) where industry is capable of conducting world-class R&D and accessing international technology sources, ATOs take on a greater facilitator role to forge industrial synergies.[4]

We can observe ATOs playing distinct roles in international innovation systems that match industry conditions

17. Some typical roles ATOs play are, among others:

    a. Technical support – helping diffuse and upgrade industry technologies where firms do not have the capability to do this, or source new and emerging technologies from overseas (model: in-licencing and out-licencing)

    b. First mover – undertaking strategic (long-term and high-risk) research out of scope of existing firms to generate novel IP, incubate start-ups and promote industry creation (model: spin-off and spin-out and incubator)

    c. Ecosystem catalyst – positioning research to anticipate the needs of future markets and help create new areas of competitive advantage (model: strategic research)

    d. Platform for industry – provide technology platforms and undertake demand-led research and development of practical utility to meet existing needs of industry (model: contract services)

    e. Facilitator – forge industrial synergies to scale up impact (model: industry consortia)

    f. Market pioneer – identify and facilitate emerging industrial opportunities in global markets

[3] Chen & Chen (2014) The evolution of public industry R&D institute – the case of ITRI, pp.49-51; and 59.
[4] Chen & Chen (2014) The evolution of public industry R&D institute – the case of ITRI, p.51.

18. Table 2 provides a high-level overview of critical roles ATOs play in relation to industry conditions. Section 3 provides further international examples of how ATO roles align with maturity, technological sophistication, and scale of industry.

Table 2. *Roles of ATOs in relation to industry conditions (role emphasis grey)*

State of industry	Technical support	First mover	Ecosystem catalyst	Platform for industry	Facilitator	Market pioneer
Developing industry *Largely SMEs*						
Mature industry *Strong medium- sized industry*						
Large scale industry *Mainstream industry are large corps & multinationals*						

19. We have insufficient evidence to conclude that the overall market environment or the state of the innovation ecosystem in NZ has materially improved since 2012 and the establishment of Callaghan Innovation in 2013. If anything, global pressures (Covid and the resulting cost of living crisis) have worsened NZ's relative global position. Indicators and indices tend to track negatively rather than positively.[5]

20. A weaker external environment coupled with New Zealand's still developing industry places us more realistically in conditions like Taiwan during formative stages of its industry. This suggests supporting technological advancement in New Zealand should begin with building the foundations of our technological capability (e.g. 'technical support', 'first mover' and 'ecosystem catalyst' functions). We are, after all, a nation of SMEs with a weak medium-sized industry and very few large-scale frontier firms. The frontier firms we do have are significantly less productive than overseas comparators.

21. At the same time, a critical change in our national innovation system over the last 20 years provides better enabling conditions for early-stage support models when industry is still developing (licencing, spin-off and spin-out, incubating, and strategic research): Our present-day commercialisation and investment environment is more sophisticated than it was 20 years ago. Now venture capitalists have significantly more capability and capacity, and our commercialisation capability more readily commercialises deep-tech.

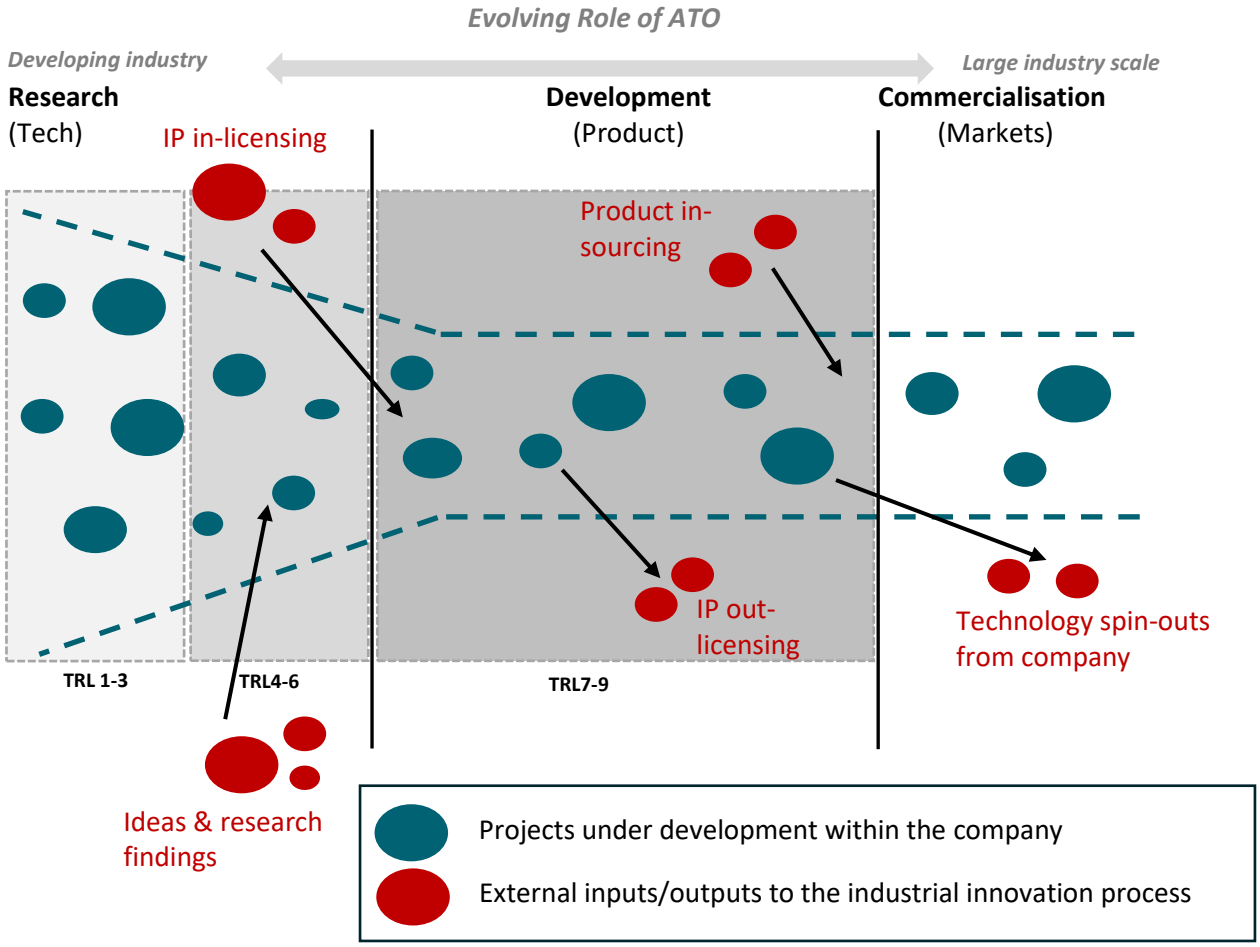
[5] Callaghan Innovation (2024) Board Paper – Strategic Direction: 'Where to from here'. *Callaghan Innovation's future state options*, p.3.

ATOs' roles determine how they interact with companies and participate in industrial innovation cycles

22. It is critical for ATOs to collaborate with industry. At the same time, industry conditions determine the extent to which ATOs need to internalise the industrial innovation process, while also supporting industry over time to own the innovation process and expand their innovation portfolios for new product development.

23. Figure 3 illustrates at a high-level the industrial innovation process from research to product development and its commercialisation. It shows spaces in which ATOs can participate in the industrial innovation cycle. They may provide inputs into the innovation process of companies, or own the innovation process where this is outside of scope of industry, and then license out IP generated as well as spin out companies.

Figure 3. *Scope for tech supports to participate in the industrial innovation cycle*



24. When industry is still developing, ATOs increase the rate of innovation by providing tech platforms, undertaking research outside of scope of firms and disseminating knowledge (TRL 1-3, basic research). They make technologies more widely available and increase the knowledge in-flows into the industrial innovation process through in-licensing or spinning out companies to take advantage of newly developed IP. This expands companies' portfolios for new product development and enhances market opportunities.

25. ATOs also provide stable infrastructure (including facilities like wind tunnels and testbed aircraft) to effectively subsidise the research costs for emerging industries to encourage innovation and experimentation. Such catalyst institutions amplify diffusion throughout the economy and wider society.[6]

26. As medium sized industry establishes itself, gets better at sourcing new technologies, and internalises more of the innovation cycle within firms, appetite for research-industry collaboration increases alongside the need to apply a critical mass of capability to solving practical problems (technology readiness levels 4-6, more applied research). Supporting tech-capability in the system can shift emphasis towards demand-led applied research – for example, through contract or 'fee for service' R&D. This works very well in Germany, but its leading applied technology research institute (the 'Fraunhofer Gesellschaft') acknowledges the way it operates relies on having a very strong and mature medium-sized business sector.

27. When firms reach significant scale, shared projects, resource pooling, and the coordination between actors in the system becomes more important. Here supporting functions take on roles of conveners and facilitators to better link up the existing capability that already has scale. They also identify and pioneer new global markets to help focus that capability.

28. Section 3 provides additional examples of how the roles of ATOs overseas align with local industry conditions.

The role of supports for technological advancement in NZ need to be tailored to the relevant developmental stage of our industry conditions and co-evolve

29. New Zealand industry is primarily comprised of SMEs with a weak medium sized industry and too few world-leading frontier firms (large scale and multinational corporations). Supports for technological advancement would likely need to take on similar roles to Finland's Technical Research Institutes, (the VTT), balancing two main roles:

    a. *Ecosystem catalyst*

       Like the Finnish VTT today, and Japan's AIST during the formative stages of its industry, the supports would need to be a hub and catalyst for advancing technological capability of firms and the national innovation system. They would do so by:

       - providing government policy with strategic leadership on identifying and prioritising critical new and emerging advanced technologies
       - driving development and diffusion of critical technologies to enhance the technological sophistication, absorptive capacity and competitiveness of industry over time, and
       - directing system-significant technological capability at scale to undertake strategic research on next-generation and prospective competitive technologies too risky or out of scope by existing firms to create new industries and competitive advantage.

[6] Paschkewitz and Patt (2023) "No, We Don't Need Another ARPA." *Issues in Science and Technology* 40:1, pp. 93–97. https://doi.org/10.58875/MMPQ3216

b. *Industry platform*

Like the German Fraunhofer Gesellschaft, the ATI would carry out research of practical utility in close cooperation with industry and the public sector, thereby:

- concentrating technological research capability at scale on solving industry problems to bridge the gap between basic research and development, and help technology cross the valley of death, and
- fostering collaboration between research (universities) and industry (firms) by orienting research groupings under its umbrella towards industry and ensuring their activities are market-oriented.

30. The roles that supports play for technological advancement in New Zealand's innovation system would need to co-evolve in step with industry. For example, Taiwan's Industrial Technology Research Institute (ITRI) has had two main roles that co-evolved with development of its national innovation ecosystem and the technological capability of firms: 'spearheading new industries' and 'upgrading existing ones'.

31. Similarly, the balance of roles of supports would need to co-evolve with sophistication of industry and business, specifically between:

a. Future-oriented: catalyse technological capability and undertake strategic research in critical technologies of importance to New Zealand to address needs and markets that will shape economies of the future.

b. Present-day: meet the needs of existing industry through demand-led research and development (R&D) work.

Section 3: Overseas examples of ATO roles that align with environmental factors and industry needs

Types of roles ATOs play in international innovation systems

32. The types of roles ATOs may take are, among others:

    a. Technical support – helping diffuse and upgrade industry technologies where in firms do not have the capability to do this, or source new and emerging technologies from overseas (model: in-licencing and out-licencing)

    b. First mover – undertaking strategic – long-term and high-risk – research out of scope of existing firms to generate novel IP, incubate start-ups and promote industry creation (model: spin-off and spin-out and incubator)

    c. Ecosystem catalyst – positioning research to anticipate the needs of future markets and help create new areas of competitive advantage (model: strategic research)

    d. Platform for industry – provide technology platforms and undertake demand-led research and development of practical utility to meet existing needs of industry (model: contract services)

    e. Facilitator – forge industrial synergies to scale up impact (model: industry consortia)

    f. Market pioneer – identify and facilitate emerging industrial opportunities in global markets

33. Table 3 provides a high-level overview of critical roles of ATOs in relation to industry conditions, which the above examples showcase.

Table 3 (reproduced). *Roles of ATOs in relation to industry conditions (role emphasis grey)*

State of industry	Technical support	First mover	Ecosystem catalyst	Platform for industry	Facilitator	Market pioneer
Developing industry *Largely SMEs*						
Mature industry *Strong medium- sized industry*						
Industry at scale *Mainstream industry are large corps & multinationals*						

Examples of ATO Roles that align with industry conditions

Germany's Fraunhofer Gesell shaft (FhG)

34. Germany has a strong focus on being a 'platform for industry' because it has a very strong medium-sized industry. Accordingly, it emphasises providing technology platforms and undertaking research of practical utility to that industry to meet its present-day needs. FhG acknowledges that this emphasis is grounded in its industry conditions, but that countries without sophisticated or strong business sectors should first emphasise building the technological capability of their innovation system and firms.

Finland Technological Research Institute (VTT)

35. Finland's VTT balances being a 'platform for industry' with being an 'ecosystem catalyst' for Finland's national innovation ecosystem. It provides technology platforms and undertakes strategic research that anticipates the needs of future markets and helps create new areas of competitive advantage on top of meeting needs of its existing industry through demand-led research and development.

Japan's Institute of Advanced Industrial Science & Technology (AIST)

36. When Japan was still building up its industry, the AIST focused on three missions broadly within the remit of being an 'ecosystem catalyst' (also covering tech support and first mover needs): i) R&D on platform technologies, including localising and diffusing foreign technologies; ii) Long-term and high-risk research out of scope of existing firms; and iii) strategic research to promote international competitiveness and creation of new industry.

Functions of overseas institutes identified in 2012 review

37. Reproduced here are insights gleaned from a 2012 review of functions of overseas institutes that underpinned the proposals of the 2012 Cabinet paper to establish a New Zealand Advanced Technology Institute. The work presented here comprises three parts:

    a. The first frames the review that was undertaken and highlights important insights as well as limitations of the descriptive analysis undertaking.

    b. The second provides a description of identified functions at a general level.

    c. The third shows the spread of functions across international institutes reviewed.

Framing the review

38. Two points are important to hold in mind when looking at this work:

    a. The R&D function concerning technology advancement was conceived in very crude terms and solely with a present-day focus, that is, meeting the needs of existing industry. The way the R&D function was identified at the time lacks strategic and leadership (policy) elements that occur within a wider time horizon, that is, anticipating industry needs of the future and creating competitive advantages that will underpin future economies.

    b. The functions of overseas institutions exclude strategic elements and roles that technology research institutions are leveraged for. This is acknowledged under the 'significant themes

and implications for New Zealand' section of the review. The high-level message is reproduced below in two parts:[7]

i. 'It is important to recognise the ways in which the range of capabilities and capital (notably skilled personnel and scientific facilities and equipment) are used strategically by institutes (and their government sponsors) to achieve not only outputs (e.g., research outputs) but also broader national aims.'

ii. 'In establishing an ATI, the needs for science and equipment capabilities (existing or new) should be considered in light of both functional and strategic roles.'

39. In respect to the strategic role of ATI's, the review pointed out that the following questions need to be considered:[8]

i. 'What critical strategic role should R&D play in an ATI environment? To help access and partner with overseas world expertise? To help firms pursue transformative business opportunities? To attract and retain world-class capability?

ii. What role could the development of technical plants and facilities have in, not only carrying out technical services for firms, but also serving as a locus for partnerships across universities, ATI and firms?

iii. What is the appropriate balance of effort between R&D and technical services? What is the role of non-technological services, such as IP management advice or business model development?'

Description of functions

40. The 2012 review identified a range of functions of a few overseas institutes and defined them at a general level in the following way:[9]

a. **R&D**, both industry-led (e.g., contract research services) or collaborative projects with other public or private partners, typically with an applied focus, and supporting both technology development and technology adaptation and adoption.

b. **Technical services**, such as product analysis, process testing, calibration, certification, access to equipment and facilities.

c. **Business services**, for example the provision of technology management courses for industry, IP management advice, market analysis and technology foresight services.

d. **Capability development** through student training (in-house or industry placements) and industry outreach and training.

e. **Facilitation of innovation activities**, for example brokering links with specialist external technology providers or R&D partners (like Global Expert, coordinating and promoting knowledge transfer in national R&D partnerships or innovation networks.

f. **Commercialisation,** of the institute's own IP, for example through licensing of own technology and development of spin-offs.

[7] MSI (2012), *Briefing B/12/051: International Models of Innovation Support for High Value Manufacturing*, pp.36-37. https://www.callaghaninnovation.govt.nz/sites/all/files/international-briefing-1.pdf
[8] MSI (2012), *Briefing B/12/051,* p.37.
[9] MSI (2012), *Briefing B/12/051,* pp.3-4.

Spread of Functions

41. Table 5 below shows the spread of functions across the institutes reviewed:[10]

Table 5. *Spread of functions (reproducing Table 1 from the review). All the institutes carry out a range of these functions (indicated by a tick), though they differ in their dominant focus (indicated by shaded box):*

Table 1: Functions of overseas institutes reviewed

(tick indicates function is present in the institution; shading indicates dominant focus)

Country (institute)	R&D	Technical services	Business services	Capability develop-ment	Facilitation	Commer-cialisation
Denmark (DTI)	✓	✓	✓	✓	✓	
Sweden (SP)	✓	✓	✓	✓	✓	
Finland (VTT)	✓	✓	✓	✓	✓	✓
UK (High Value Catapult)	✓	✓			✓	
Taiwan (ITRI)	✓	✓	✓	✓	✓	✓
Korea (KIST)	✓			✓		✓
Singapore (A*STAR/ SIMTech)	✓	✓	✓	✓	✓	✓
Queensland (QMI)			✓		✓	

[10] MSI (2012), *Briefing B/12/051,* p.4.

Section 4: Possible Ways to Embed Leadership Supports for Technology in New Zealand's National Innovation System

Critical Functions	Examples of International Arrangements				Key Questions
Strategic tech leadership	**EU**	**Germany**	**Finland**	**Australia**	**New Zealand**
System-wide direction-setting Identification of tech priorities, focus areas, economic opportunities for New Zealand, and areas of collaboration with industry.	**FORM** The European Commission sets out regulation by which Strategic Technologies are supported at different stages of upstream development, including critical manufacturing capacities for large scale production through concerted effort of European institutions across countries. **ACTIVITY** • determines technology fields that are crucial for Europe's leadership • identifies target areas (such as: deep and digital tech, clean tech and biotech) to ensure EU technological sovereignty and which introduce innovative, emerging, and cutting-edge elements with significant economic potential to the internal market, and/or help reduce or prevent strategic dependencies of the Union.	**FORM** Ministry for Education and Research sets out a 'High-Tech Strategy Innovations for Germany' that enhances structural and sectoral policies through improving framework conditions of Germany's research, development, technology and innovation (RDTI) system. **ACTIVITY** • offers framework for RTDI policies; objectives adapted and refocused on emerging and strategic needs every legislation period. • defines long-term missions to be accomplished as a concerted effort across almost all (fed.) ministries. • Aligns departments on the goal to ensure good ideas are translated quickly into innovative products and services, because this drives prosperity & quality of life. • develops a comprehensive, inter-departmental innovation strategy	**FORM** An Advisory Body in the form of a Research and Innovation Council that is chaired by the Prime Minister and involved industry. The term of the Council lasts for the duration of the electoral term. The term of the ministerial members of the Council is limited to the duration of their ministerial term. **ACTIVITY** • determination of key issues relating to the development of research and innovation policy that supports wellbeing, growth and competitiveness • support the government in the development and coordination of long-term research and innovation policy • monitor changes in the national and international operating environment, and put forward initiatives related to research and innovation policy	**FORM** Department of Industry, Sciences and Resources signals critical technologies of national interest through a Critical Technology Statement Critical Technology Statement. **ACTIVITY** The Critical Technology Statement sets out the Government's commitment to critical technologies and activities: • align Australia's critical technologies ecosystem • support consistency and coordination across related government activity • improve the technology investment environment – identify priority fields • inform other priority setting mechanisms	**First-order question:** • Do we want to have a tech direction setting function embedded in New Zealand national innovation system? • Who should own this role? **Second-order questions:** • Should this function sit within or outside of, or at arm's length of government? • If within government, should this function sit within MBIE or some other government department? • If at-arms-length, should it be a commission or a Crown entity? • If joined up (Govt & industry), should it be a joint Govt-Industry Tech Research Council?
Tech advice to Government Sensing, scanning, foresighting, and the identification of domestic and international demand, including critical technologies for New Zealand that need protecting or provide unique opportunities.	**FORM** The European Commission hosts the Strategic Technologies for Europe Platform (STEP) Committee comprised of Commission experts. **ACTIVITY** • advises on how to safeguard and strengthen the value chains, and how to address shortages of labour and skills • awards a quality label ('Sovereignty Seal') to any action contributing to any of the STEP objectives to help projects attract public and private investments • hosts a dedicated website ('Sovereignty portal') to provide investors with information.	**FORM** The Ministry hosts a High-tech Forum (Futures Strategies) supported by a whole-of-government approach involving a range of Ministries, including a dedicated secretariat. The Forum is composed of experts from civil society, economics and industry and science. **ACTIVITY** • provides guidance and makes specific recommendations for implementing the HT Strategy. • advises government on research and innovation politics, and provides technical and strategic support to the mission streams. • analyses cross-mission themes • advises the prime minister alongside the 'Futures Council of the Prime Minister'.	**FORM** Housed in the VTT, a public sector research institute (a fully state-owned limited liability company) that sits underneath 'Business Finland' (equivalent to Callaghan/NZTE business support and trade roles), which report to the Ministry of Economic Affairs and Employment (equivalent to 'MBIE'). **ACTIVITY** • advisor to the public sector on most systemic and technological challenges, including the promising enabling and assembling technologies • a strategic partner for companies, universities, other research organisations, research funders, ministries, associations, and municipal and regional administration.	**FORM** Critical Technologies Hub (a unit) housed within a government department. **ACTIVITY** • advises government on critical technology opportunities • advises government on developments and risks of critical technologies • is supported by expert advice from economic, national security and scientific nodes.	**First-order questions:** • Do we want to have a tech advisory function for government embedded in our national innovation system? **Second-order questions:** • Should a Ministry (e.g. MBIE) or central agency (e.g. DPMC) internalise this function, like a unit in a department? • If not, should this function sit outside of government or at arm's length? → within an ATO or some other entity in NZ's existing SI&T sector? • Could the advisory function sit within a forum, commission, or advisory board?