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***Science, Technology and Research\* Cooperation in Australia-Japan Relations: Beyond Hydrogen***

It is increasingly clear that science, technology and research (STR) will play vital roles in economic success and in diplomatic relations in the near and longer term. Australia has much stronger performance in all these areas than is widely known. Per capita, our research output and impact is among the highest in the world. Australia's unilateral strength is not widely known in Japan nor are the ubiquitous bilateral collaborations in science, technology and research between Australia and Japan. Their scale and scope are little known among policy makers, businesses and the public. There is therefore, immediate potential for influencing the perception of Australia in Japan by raising awareness of our current success. In the medium to longer term, there is great scope for expanding bilateral cooperation in these areas and providing a role model for science, technology and R&D collaboration for the region. In addition to the public value, the business value of collaborations is significant and the knock-on effects to international education also has economic potential.

This submission makes proposals in three areas: changing perceptions of Australia in Japan, strengthening collaborations and creating new STR linkages, particularly with Japanese industry, and reinvigorating the institutional structures to shape this crucial element of the future bilateral relationship.

*The Issue*

Japan and Australia are important strategic allies in the Indo-Pacific. New elements in the relationship such as the growing security relationship are testament to how important a pillar the relationship is in the region. The new elements build on the strong history of the relationship, and it is useful to recall that traces of these new elements can already be found in the history. The origin of the strong A-J economic relationship came from the natural complementarity of economic endowments, but it depended on the vision of key individuals immediately after the second WW who saw that re-engaging Japan in the international community was vital to Australia's interests. They were able to see beyond their present to a different world, and they understood that our economic relationship with Japan would build economic and physical security in the region. In the 21<sup>st</sup> century, as Industry 4.0 and Japan's Society 5.0 become realities, the nature of economic engagement between us should be expected to change again. New industries, addressing key problems like climate change and ageing societies, and technological transformations that help traditional industries transition to zero-emissions operation, will become increasingly important. As in the past, we have some natural complementarities that we should exploit to be leaders in addressing these developments.

At present our economic relationship is still perceived to rely on trade in the core minerals, energy and agriculture sectors but is in fact much broader. Both countries have growing trade in advanced industries, and technical advances on both sides are key to the continued strength of the traditional mainstay industries (e.g. driverless vehicles in remote mines, satellite sensing in harsh environments in agriculture and minerals sectors, space cooperation, construction and infrastructure support industries). If these remain invisible, new industry players may not look to Australia as a partner and source of technological advantage.

\* I use the term research to include both research ("blue sky") and development ("applied research")

Australia ranks 23<sup>rd</sup> and Japan 16<sup>th</sup> in the Global Innovation Indicator rankings of 131 countries for 2020. Neither is in the top 10 for high income countries. On many indicators both countries are good but not stellar performers. But innovation and technology outputs are important for both. Both countries' high tech exports share in manufactured exports are already close to the OECD average of 18% (Japan 17% and Australia 19%, OECD 18% on World Bank data for 2017-2019 averages) but far behind China at 30%. Both countries' governments and business communities frequently stress the importance of innovation in public statements. However innovation outputs require a wide range of innovation inputs and many of these need government initiative or support. Both countries have potential to improve performance, and collaboration will contribute impetus.

We have formidable research collaborations in place with Japan but little information about them and there is little formal public support. It is not easy to draw a picture of our joint activities from publicly available data, though it could be done with a little effort and one recommendation is to undertake such a study. Available data show that there are around 100+ new scientific co-publications with Japanese and Australian authors per week. Universities Australia report around 200 agreements between our universities and the Herbert Smith Freehills annual survey of inward FDI by Japan into Australia notes an increasing number of technology-related deals over the last 3 years.

The gaps in information on the nature of our science, technology and research relationship are clear from the frequent requests from front-line officers in Tokyo for a "mapping" of the relationship. Even staff with many years of experience in Japan and in Australian public service assume there will be a straightforward way to understand where our research and innovation strengths lie and where they overlap with Japan. New staff arriving in Tokyo inevitably ask for a "mapping" as the first step to implementing whatever is the technology strategy of the moment. Frustratingly, no convenient mapping exists though it would be possible to create one given appropriate resources.

Understanding the potential for collaboration is made more difficult by the decentralized organisational structures in Australian government and semi-government agencies related to these fields. Responsibility for national science, technology and research policy is distributed across several Australian government departments plus the research councils, and they in turn collect input from the learned societies and several representative bodies for different university networks (e.g. Universities Australia, the Group of 8, the Australian Technology Network of universities, and the Regional Universities Network). Departmental names and responsibilities have changed frequently in recent years. Furthermore, "national" statements of policy on innovation, research and technology development have often been replaced with different statements reflecting changed policy priorities of different governments. In parallel, government funding schemes for R&D have proliferated, morphed and been restructured. [In 2021-2 a new Global Science and Technology Diplomacy Fund will supersede its predecessor the Global Innovation Strategy which itself had 5 constituent parts. These funds are in any case only one cog in the machinery of government funding for R&D]. From the outside (and possibly even from inside), the structure can appear to lack coordination and be difficult to navigate. There is certainly no one-stop shop for international partners looking to understand Australian research and technology priorities and funding opportunities.

In this environment the organisations on the ground in Japan that bring together Australian-Japanese collaborations in research, technology and related business assume very large significance.

In 2018 the Foundation for Australia-Japan Studies ([www.fajs.org](http://www.fajs.org)) started operations in Tokyo, calling for research grant applications from teams incorporating Australian and Japanese researchers and their industry partners. The FAJS mission is to raise the profile of Australia-Japan collaboration in science, technology and innovation and support the people who are transforming the bilateral relationship by facilitating private sector funding to support collaborations between academic institutions, industry and government in Australia and Japan. Over the course of its first three years' operation FAJS attracted close to 300 applications of high-quality projects and funded 11. The data about those applications give valuable information about potential projects and partnerships that could be encouraged if more philanthropic private funding, or public funding, were available.

In 2019 a networking organisation for Australian, New Zealand and Oceanian researchers in Japan was established for the first time: ANZOR Japan (<https://www.linkedin.com/groups/13772340/>). ANZOR Japan organises seminars and workshops showcasing Australian collaborative research with Japan and has around 30 active members. Combining ANZOR's network with the Australian JSPS fellows in Japan and the Australian JSPS Alumni Association, it is now possible to contact a sizeable group of active Australian researchers in Japan who can share their experiences and provide guidance to new arrivals. They have a unique perspective on what works well and where the barriers are to effective research collaboration.

The Australia New Zealand Chamber of Commerce Japan set up a new committee on Technology Innovation Education and Research to join its other sectoral committees, reflecting the realization by member companies of the importance of collecting and sharing information on the emerging business opportunities in these areas in Japan.

*Why now ?*

2020 marked the 40<sup>th</sup> anniversary of the Australia-Japan Science and Technology Treaty. There were several landmark collaborative innovations under the treaty: Questacon, the Australian National Beamline Facility at KEK's Photon Factory, landing of Japan's Hayabusa I asteroid probe in Woomera, South Australia in 2010 and recovery of the Hayabusa II capsule at Woomera in 2021. (<https://www.industry.gov.au/news/australia-and-japan-40-years-of-international-collaboration-on-science-technology-and-innovation> and <https://www.industry.gov.au/news/australia-japan-cooperation-in-science-and-technology>). Important as the celebration of these events has been, the business and university research outcomes under the Treaty have been less visible.

The last Japan-Australia Joint Science and Technology Cooperation Committee meeting was held in 2019 in Japan. The next is likely to be hosted in Australia in early 2022. This is an important opportunity to develop a strong agenda that could address some of the issues raised in this submission.

The two prime ministers held a bilateral summit meeting in the margins of the G7 meeting in early 2021 and their joint statement stressed the desire to cooperate on innovation and technology. They announced a partnership on decarbonisation that is to be a "technology-led initiative" that will parallel a similar one between Australia and Germany. As noted in another submission to this enquiry, the reality of the Australia-Japan collaboration has yet to match the strength of that with Germany, despite the natural complementarities between us.

The Australia-Japan Conference initiated by Prime Ministers Koizumi and Howard to reinvigorate the relationship in 2001 has not been held since 2013. For some years it did provide a focus for government, industry and academia to discuss new directions for the bilateral but it began to lack

energy in its later meetings. Now would be a good time to revive it with a focussed agenda to discuss cooperation on the big issues of our day.

With both governments proclaiming a focus on innovation and technology and a commitment to decarbonisation and the research needed to achieve it, along with the obvious need for international collaborations in pandemic-related research, the next few years provide a critical window to build the stronger base for our collaboration. The meetings and organisational structures described here provide us with the means to do that, but it requires commitment and action.

Importantly the non-government organisations provide a broader focus on emerging issues than government bodies which tend to focus on the current political agenda. Hydrogen is an example. Important and fruitful as our collaboration will be, there are many other issues with major potential once the hydrogen technologies are in place. If we fail to build collaborations with Japan across a well-targeted but wider spectrum, those opportunities are likely to be more expensive to develop later and we will be lagging behind international competitors.

### *Complementarities*

An additional reason to focus on Australia's collaboration with Japan particularly, among the various possible international collaborations, lies in the complementarities in our research ecosystems.

The major difference in the research landscape is the large role played by in-house business sector research. Around two thirds of Japan's research is estimated to be carried out by companies, with one third in universities. Australia is roughly the reverse. The Japanese government has increasingly focussed public funds for university research into a select group of institutes while restricting the overall growth of public research funding. Australia has some programs that support targeted, theme-based institutes (e.g. the CRC program) but is arguably less selective with funding than Japan.

At the same time, we share many similarities. Publicly-funded universities play a large role in the university sector; the number of research-intensive universities is smaller than the population of universities; our governments are encouraging business-university collaboration in research but in both countries this is a recent development; we share a time zone which makes virtual collaboration very efficient; we share broadly similar approaches to intellectual property from publicly-funded research.

The large numbers of co-publications suggest there are significant overlaps in fields of research excellence, but also that our expertise within fields differs sufficiently to be synergistic rather than competitive. Beyond the content of research, Australia has strengths in research management in public institutions that Japan lacks. Research management is a professional career with accreditation and training opportunities in Australia but not yet in Japan. On the other hand, Japanese firms have experience that Australia lacks in organising large, in-house research projects. We could be sharing this expertise and training talent in both places.

### *Recommendations*

This brief summary of aspects of the Australia-Japan science, technology and research relationship leads to the following recommendations for the future.

#### ***I Changing the perception of Australia in Japan***

- a. Support organisations that bring together researchers and entrepreneurs and that give opportunities to showcase collaboration and provide information on business opportunities in new fields. The organisations mentioned above (FAJS, ANZOR, ANZCCJ TIER) are an important part of this strategy on the ground in Japan. At home in Australia the JSPS Alumni association is a further valuable resource. Some of them will benefit from modest amounts of government funding (ANZOR and JSPS Alumni) while others should be privately funded but need enthusiastic support from government to signal their value to potential private funders. There are other avenues that give a platform to young Australian researchers, such as the Falling Walls and 3M Thesis competitions (the latter an Australian invention recently introduced into Japan for PhD researchers to compete in non-technical explanations of their topics). Innovation Dojo in Sydney provides training for Australian start-ups interested in breaking into the Japanese market and is all the more necessary because of the lack of a Landing Pad program in Japan similar to those provided in San Francisco, Tel Aviv, Shanghai, Berlin and Singapore (<https://www.austrade.gov.au/landingpads>). [The absence of a Landing Pad in Japan presumably reflects the misperception that there is no startup ecosystem there.]

The activities of these organisations are not coordinated and while they receive informal support from the Embassy in Tokyo (such as circulation of notices of their events) there is no “Team Australia” approach. The whole of these activities could be more than the sum of the parts.

*Actions:*

1. Add a page to the Embassy’s website to advertise and celebrate science, technology, innovation and research events in the same way that cultural events are promoted. The Australian Embassy in Berlin provides an example of how this might look with its Showcasing Australia tab <https://germany.embassy.gov.au/beln/home.html>.
  2. Seriously consider opening a Landing Pad program either in Tokyo or Osaka. The idea that there is no start-up culture or ecosystem and that it is difficult to set up a company in Japan is an outdated notion that does a disservice to both countries.
- b. Japan provides generous funding to bring foreign researchers to Japan to work in public and private research labs. Many distinguished Australian scientists have been Japan Society for Promotion of Science (JSPS) Fellows. Japan also provides funding for, and takes leadership roles in, regional collaborative research programs such as the e-Asia Joint Research Program. In Japan Australia is perceived to provide limited support for these programs and to receive more than it gives in bilateral research funding.

*Actions:*

1. Provide reliable support the Australian Academy of Science management of the application process for JSPS Fellowships should be confirmed for the long-term rather than subject to short term renegotiation. If we are not providing similar

funding in the reverse direction at least we should be seen to enthusiastically support Australians applying for Japanese funding.

2. The ARC should join the e-Asia JRP. At present only the NHMRC is a member, so Australia is only able to propose projects in the medical field. All other fields are funded by ARC which is not a member, and as a result Australia does not participate in joint projects in any other field. The Japanese perceive this as frustrating evidence of an Australian reluctance to engage in regional collaboration.
3. Consider an Aust-Japan Science event at Questacon – similar to European Science week – and support mini Science Circus events in Japan more often.

## ***II Building future collaborations and sell Australia's capability more effectively***

- a. As noted, there is no current description (map) of Australia's research strengths nor of the range and depth of Australia-Japan collaborations in STR. Both Australians and Japanese working to promote the bilateral relationship find this frustrating and an added barrier to making a strong case to Japanese policy makers and businesses that Australian is a strong potential partner.

### *Actions*

1. Undertake a project to map the Australia-Japan bilateral co-operations in STR. This is probably best done by commissioning a study by a university research team on terms agreed with the relevant departments and agencies. There are useful methodologies that could be applied to such a study and to have lasting value it needs to be more than purely descriptive of the present state of affairs.
2. Support initiatives like the FAJS program to engage private finance in funding exploratory and applied research with potential value to the future bilateral relationship. The FAJS model is both original and effective and could be scaled up to have major impact, with financial returns from some of the funded projects and lasting bilateral research relationships from others. Australian firms are relatively new to this type of CSR activity that supports research activities with social as well as business outcomes. Government needs to support, cajole and persuade industry to come to the table on this type of activity.
3. Make the existing Science and Technology agreement work harder. Large scale research infrastructure projects are something we can be very proud of. We also need to use the agreement to build the people-to-people collaborations that cement the relationship and ensure that research breakthroughs result from joint Australia-Japan discovery activity. Bringing the research community and business more actively into the consultations under the Agreement, and into the Joint Science and Technology committee meetings in a more systematic way, will help policy makers identify future trends and understand complex research fields that can be harnessed for the bilateral relationship.
4. Use AusTrade more effectively in STR. AusTrade has valuable local knowledge about which companies are developing what types of technology. At present it is not empowered to develop the understanding of the research community that is needed to connect their local knowledge

with Australia's research strengths. It is unnecessarily difficult for them to make matches between interested companies and Australian research teams. Occasionally they create a great match, but it is a rather haphazard process and could be made more systematic and stronger by a rethink of how AusTrade represents and connects Australian STR abroad.

5. Support networking organisations such as ANZOR, ANZCCJ and others described here to create the pool of research talent with deep knowledge of Japan that can continue to build and advise on research collaborations in future. The amount of money needed to sustain these organisations is very small and represents very good value for money.

### **III *Reinvigorating institutional structures for the bilateral STR relationship***

- a. As noted, the decentralised and divided responsibility for STR matters in the Australian government and university sector make it more difficult for other countries to identify where to seek advice and support to build partnerships with our centres of research excellence and individual research teams.

#### *Actions*

1. Create an Australia-Japan science-technology cooperation committee to examine and address this issue. The model could be similar to the Australia-German Advisory Group or it could be a task delegated to an existing organisation with strong knowledge of the bilateral relationship, such as the AJBCC. The committee might not need to be permanent but should be given a long enough life to effectively bring about change and create some long-lasting structures that would have sustained impact. It is often politically more appealing to address one specific problem at a time (for example, to create an advisory committee only looking at research needed to deliver a bilateral decarbonisation strategy) but such bodies are transient and only address the problems that government has already identified. They are not able to identify the future (unknown) problems where bilateral collaborations have potential. What is needed is a structure to sustain the potential for STR collaboration long into the future, beyond Industry 4.0 and Society 5.0; a structure that will build a vision for the bilateral relationship as our world changes and our known technologies are outmoded and replaced.