European Commission

Roadmap for EU - Australia S&T cooperation

1. AUSTRALIA as a partner of the EU

With a population of 24,5 million, a GDP of $1100 billion and a GDP per capita of $45514[1], Australia stands as one of the most economically developed countries. Australia is an important economic and trading partner for the EU. In 2016, it ranked as the 19th largest trade in goods partner of the EU while the EU represented Australia's third largest trading partner after China and Japan. Total trade in goods amounted to €45.5 billion in 2016 with a trade balance of €19.4billion. Traditionally, Australia's exports to the EU are dominated by mineral commodities (fuels and mining products) and agricultural products, while EU's exports to Australia are predominantly manufactured goods. Total trade in services between EU and Australia in 2015 amounted to €29.3 billion with a balance of €10.3 billion.

The European Union and Australia established diplomatic relations in 1952 which have grown over the years to many areas from a predominantly economic partnership to a politically strategic one. In April 2017 the EU and Australia ended preparatory work for potential trade negotiations. The European Commission has recommended the launch of negotiations for a Free Trade Agreement (FTA) in order to remove existing market access barriers in Australia for goods, services, investment and public procurement. An FTA with a like-minded partner as Australia would benefit stakeholders from both sides - manufacturers, services industry, traders and their workforce as well as consumers and regulators. On 7 August 2017 the leaders of the EU and Australia signed a 'Framework Agreement' which will provide the legal framework for cooperation and will encourage closer links between leaders across government, business and civil society.

Australia and the EU have a long history of productive research collaboration, underpinned by the first treaty-level science and technology agreement signed by the EU with an industrialised country in 1994. The meetings of the Australia-EU Joint Science and Technology Cooperation Committee (JSTCC) are the principal mechanism for setting bilateral Australia-EU research collaboration priorities and monitoring cooperation.

The predominant fields of Australia – EU research collaboration through the EU Framework Programmes have been on health; research infrastructures; information and communications technologies; and food, agriculture and biotechnology. There has also been some collaboration in areas such as energy and the environment, and in social sciences and humanities. The 2016 JSTCC meeting discussed cooperation framework conditions and thematic priorities, including reinforced collaboration in the areas of historically strong mutual engagement (research infrastructures, health, bioeconomy, earth and marine observation, metrology), while acknowledging the need for fostering stronger links in other fields.

[1] Based on purchasing power-parity, current international dollar. Data for 2015 from UNESCO Institute for Statistics (retrieved 9/10/2017).

R&I landscape in Australia

Australia's gross domestic expenditure on research and development (GERD) intensity has increased over the past twenty years from 1.66% in 1996 to 2.1% in 2013, reaching a GERD of $23.1 billion. In line with its industrial structure, with 61.9% of R&D financed by the Business Sector[2], Australia benefits from a highly R&D intensive employment market, with 4531 researchers per million inhabitants in 2010[3].

Australia attracts a large population of students from abroad (e.g. from Asia) and it is very strong in university and public research, with 23 universities ranked in the ARWU Top-500 Universities' list for 2017. Furthermore, the country's publications output in top ranked academic journals is significantly larger than the OECD median (due to high levels of cooperative involvement with overseas research efforts). Australia produces publications with higher citation impact compared to EU28 in the areas of general medicine and nursing, geology, chemical engineering, or environmental chemistry[4].

The innovation output, as measured by triadic patents, is below the OECD median, while trademark registrations are slightly above. Australia has a large share of SMEs and start-ups. Young firms are fairly active in patenting. Based on PCT patents, compared to the EU28 there is a stronger specialisation of Australia in nanotechnologies, medical technologies, pharmaceuticals or ICT. Australia also maintains a strong and clear international specialisation in biotechnologies[5].

Furthermore, Australia performs well on skills indicators. Based on the PISA results of 2015, Australia's 15-year-olds have scored significantly above the OECD average as regards science (ranking 4th in the OECD area), maths and reading, but their main scores have declined in all areas since 2006.

Under the National Innovation and Science Agenda (NISA) Australia adopted a 'Global Innovation Strategy' which seeks to align existing and new initiatives, address known vulnerabilities and challenges through international collaboration and start-up support and to shift engagements towards multi-partner collaborative projects. The strategy leverages and builds on existing government initiatives to enhance whole-of-government global engagement; build business-research collaboration; draw talent and investment into Australia; increase links to global value chains; and facilitate an innovative open market place for Australian businesses and researchers in the Asia-Pacific. The EU is identified as one of the priority economies for collaboration.

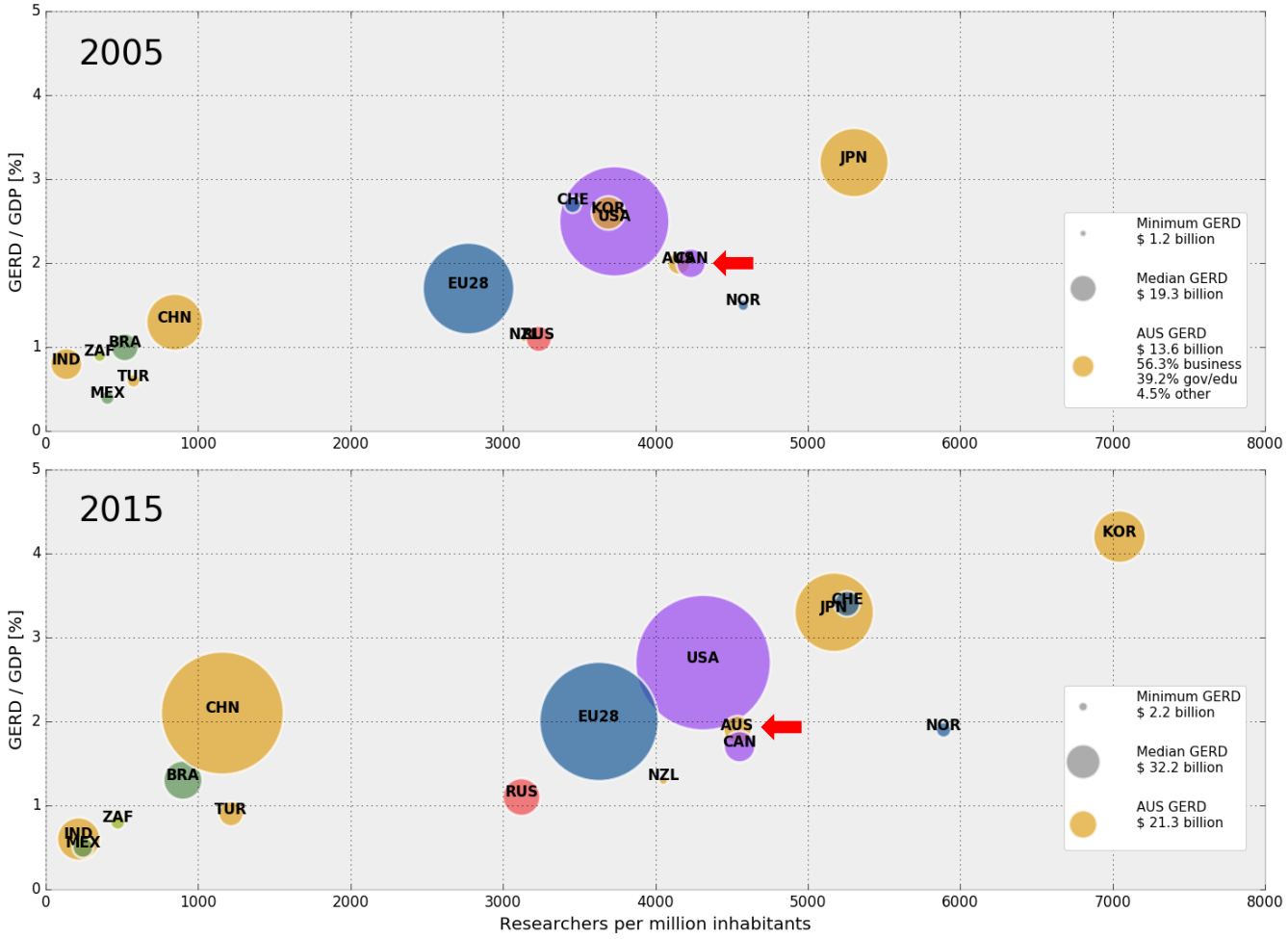
[2] Based on purchasing power-parity, current international dollar. Data on BERD from 2008. Data from UNESCO Institute for Statistics (retrieved 9/10/2017

[3] Counted in Full Time Equivalent. Data from UNESCO Institute for Statistics (retrieved 9/10/2017).

[4] See figure 3 of the Annex.

[5] See figure 4 of the Annex.

Figure 1: Expenditures in Research & Development and researchers per million inhabitants



Note: GERD in current PPP; Top chart: Data for CHE from 2004. Bottom chart: Data on researchers per million inhabitants for BRA from 2014, for CAN from 2014, for MEX from 2013 and for AUS from 2010.
Source: DG RTD - International Cooperation
Data: UIS, OECD, EUROSTAT; extraction date: 11/10/2018

2. State of play of EU-AUSTRALIA S&T cooperation

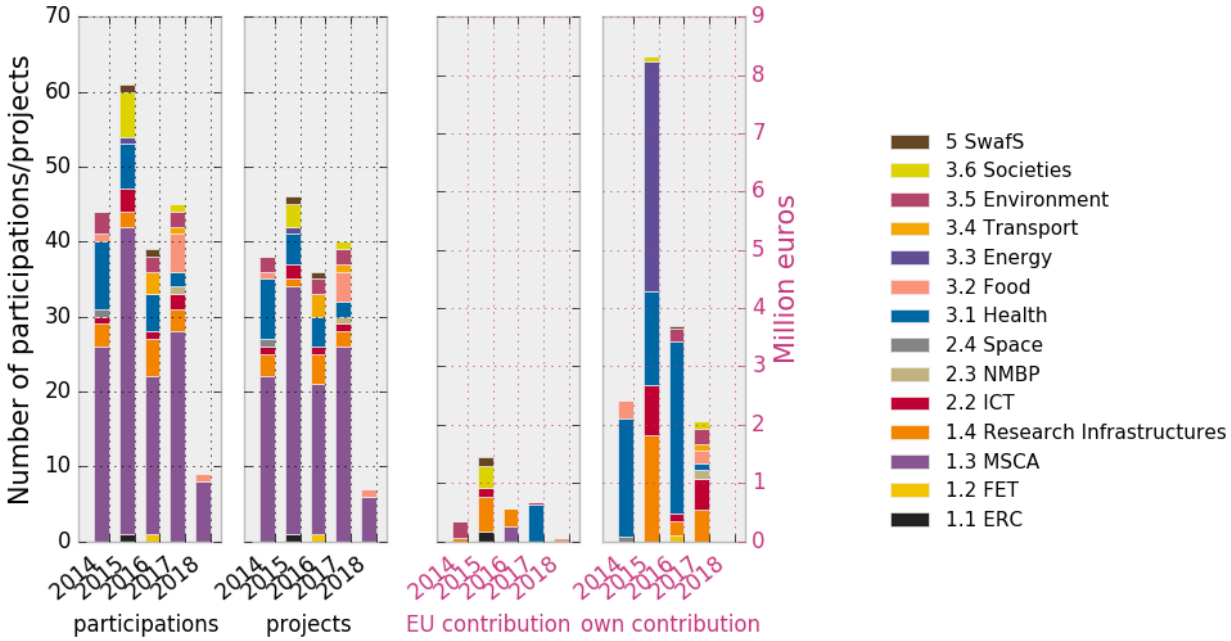
2.1. On-going FP7 and Horizon 2020 cooperation

Under FP7, Australian applicants submitted 1114 eligible proposals involving 1214 Australian applicants in response to 493 FP7 calls, leading to 324 grants where Australian entities participated 375 times. Australian participants have received €12.6 million euros from the European Commission.

Collaborative actions saw 200 Australian participations in 170 funded projects. Regarding Marie-Curie actions Australian entities participated 172 times and a total of 459 researchers of Australian nationality were involved. In the European Research Council (ERC) grants Australian entities participated 3 times to signed ERC grants, receiving 0.6 million euros, and a total of 23 Australian nationals have acquired an ERC grant.

Under Horizon 2020 up October 2018, Australian entities have participated 198 times to 167 signed grants of collaborative, MSCA and ERC actions of Horizon 2020, receiving 5.4 million euros of direct EU contribution while 17.2 million euros is the non-EU budget of Australian beneficiaries. In collaborative actions of Horizon 2020 Australian entities have 73 participations in 59 signed grants. Furthermore, Australian entities have participated 124 times in MSCA and a total of 142 researchers of Australian nationality were involved in those actions. In the ERC grants Australian entities participated in 1 signed ERC grant, and a total of 21 Australian nationals have acquired an ERC grant.

Figure 2: Participation of Australia in Horizon 2020



Note: Participations of beneficiaries, third-parties and partner-organisations.
Source: DG Research and Innovation - International Cooperation
Data: CORDA (JRC, EIT and art.185 not included); extraction date: 15/10/2018

2.2. Current framework conditions for EU-Australia S&T cooperation

At the 2016 EU–Australia Joint Science and Technology Cooperation Committee (JSTCC)6 meeting participants agreed on the importance of improving cooperation framework conditions and thematic priorities including the International Bioeconomy Forum, research infrastructure, health, earth and marine observations and metrology were discussed.

Within the field of health research, Australia is providing support to Australian researchers participating in SC1 of Horizon 2020. The NHMRC7-EU Collaborative Research Grants scheme aims to provide assistance to Australian researchers to participate in multinational research collaborative projects with international researchers that have been selected for funding under Horizon 20208. Australia's competitive grants programs also support significant levels of international research and innovation collaboration, including those through the Australian Research Council (ARC), the NHMRC and the Global Innovation Strategy.

In view of enhancing collaborations of business and research communities, the EU would welcome further progress in facilitating co-funding of research and innovation projects. Advanced cooperation could also provide better opportunities for Australian researchers to be part of the world-wide recognised ERC grants. Better awareness raising on the importance of improving framework conditions would be essential for significantly stepping up the level of R&I cooperation.

3. Priorities for the future in S&T cooperation

3.1. Areas of future S&T cooperation agreed at latest Joint Committee/High Level Dialogues

At the 2016 EU-Australia JSTCC meeting both sides emphasized the need to deepen, scale and open up cooperation in selected thematic areas:

- In the *Bioeconomy* area, the participants welcomed the recent launch of the International Bioeconomy Forum (IBF) and agreed to explore how it could be used as a mechanism for greater collaboration.

- In the *Research Infrastructures* area, positive cooperation is evident across a range of diverse infrastructures. Initiatives for cooperation in the field also include the Research Data Alliance, launched in 2013, the signing of three Memoranda of Understanding in the field of biomedical and clinical research in

[6] 14th JSTCC plenary meeting held at Brussels in October 2016 – http://www.science.gov.au/international/International-science-news-and-events/Documents/Report-14th-EU-Aus-joint-science-technology-committee-meeting.pdf.
[7] National Health and Medical Research Council.
[8] https://www.nhmrc.gov.au/grants-funding/apply-funding/nhmrc-european-union-collaborative-research-grants

2014, the close cooperation in the area of neutron science and operating synchrotrons for structural biology and the exchange of maritime science data. The scope of opportunities for further collaboration can be refined after the finalisation of Australia's National Research Infrastructure Roadmap in 2017.

- Australia and the EU cooperation in the field of *Health* is excellent, especially through the NHMRC-EU Collaborative Research Grant scheme and the participation of Australia in multilateral initiatives aimed at addressing health challenges, such as the International Rare Diseases Research Consortium and the Global Alliance for Chronic Diseases. In 2015 Australia joined the Global Research Collaboration on Infectious Diseases Preparedness. Furthermore, both Australia and EU are members of the Human Frontier Science Programme. Australia also participates as a Third Country member of the EU Joint Programme – Neurodegenerative Disease Research and it is Associate Member of the European Molecular Biology Laboratory. As well as advancing on bilateral discussions, it was also agreed to explore Australian participation in the Joint Programming Initiative on Antimicrobial Resistance (JPI AMR)[9].

- The JSTCC also noted that cooperation in the field of *Earth and marine observations* was essential and both parties agreed to explore further collaboration opportunities, particularly around applications of earth observation data, including Copernicus data. The European Commission works closely with Australia on the Global Earth Observation System (GEOSS), including in the context of the Executive Committee, of which Australia is also a member.

- As research metrology influences a wide range of fields (such as energy, health, environment and industry) it was agreed to explore further collaboration opportunities, particularly in the development of new measurements and standards.

3.2. Potential new areas of future S&T cooperation

In addition to the above-mentioned thematic areas, further avenues for EU – Australia collaboration in fields of mutual importance may include:

- *Energy:* The cooperation with Australia in the energy research and innovation has been successful so far, in particular in the area of Carbon Capture and Storage (CCS) and Concentrated Solar Power (CSP). The EU and Australia are both members of Mission Innovation, an initiative focused on the acceleration of the clean energy innovation.

- *Transport:* The area of transport offer opportunity for scaling up cooperation in areas of mutual interest such as aviation R&I or automated road transport.

[9] http://www.jpiamr.eu/

- *Environment*: The EU and Australia show a deep interest in sustainable cities. Cooperation could also be enhanced through multilateral initiatives as Belmont Forum or Future Earth programme.

- *Ocean research*: The Horizon 2020 international cooperation project called 'MESOPP'[10] (2016-2019) aims to enhance research and innovation cooperation with Australia. Within a consortium of 8 European and Australian partners the project develops research e-infrastructures (standardised methods and datasets for biomass estimates of micronekton organisms in ocean ecosystem models) linked to ocean research.

- Nanotechnologies: Also as a follow-up of previous work in the OECD, there is potential to step up further cooperation in the area of nano-safety governance.

- *Innovation*: Australia's "Global Innovation Strategy" as part of NISA (see section 1) offers opportunities for industry-academia and SME collaboration in innovation-driven sectors and it opens further avenues for creating innovation-driven cooperation between European and Australian business entities. The Cooperative Research Centres (CRC) Programme aims to foster quality research to solve industry-identified problems through industry-led and outcome-focused collaborative research partnerships between industry entities and research organisations. The Industry Growth Centres established in six key sectors will also boost competitiveness and innovative capacity of Australia's key industry sectors, also giving the potential for further international cooperation with Europe. There is existing collaboration on the European Open Science Cloud initiative with the Australian National Data Service (ANDS), which is also important in view of further dialogue.

3.3. Improvements in framework conditions agreed at latest Joint Committee/High Level Dialogue and additional framework conditions to be addressed at future policy dialogue meetings

Further to the last JSTCC meeting and in order to emphasise the mobility of senior researchers for the benefit of European and Australian universities and higher education institutions and research institutes, the Australian Research Council has been approached for exploring a bilateral agreement with the European Research Council.

[10] http://www.mesopp.eu/

ANNEX:

HORIZON 2020 WORK PROGRAMME 2018-20 TOPICS EXPLICITLY ENCOURAGING COOPERATION WITH AUSTRALIA

	Topic identifier	Topic title
2018	INFRAIA-01-2018-2019	Integrating Activities for Advanced Communities
	NMBP-13-2018	Risk Governance of nanotechnology (RIA) (closed by now)
	NMBP-14-2018	Nanoinformatics: from materials models to predictive toxicology and ecotoxicology (RIA) (closed by now)
	MG-2-5-2018	Innovative technologies for improving aviation safety and certification in icing conditions (closed by now)
	DT-ART-01-2018	Testing, validation and certification procedures for highly automated driving functions under various traffic scenarios based on pilot test data (closed by now)
	DT-ART-02-2018	Support for networking activities and impact assessment for road automation (closed by now)
2019	NMBP-15-2019	Safe by design, from science to regulation: metrics and main sectors (RIA)
	DT-SPACE-06-EO-2019	International Cooperation Copernicus – Designing EO downstream applications with international partners
	SU-SPACE-22-SEC-2019	Space Weather
	DT-ART-03-2019	Human centred design for the new driver role in highly automated vehicles
	DT-ART-04-2019	Developing and testing shared, connected and cooperative automated vehicle fleets in urban areas for the mobility of all

All Work Programme 2018-2020 topics in Horizon 2020 are open to the participation of Australian partners!

Figure 3: Australia – Top scientific areas compared to EU28 in terms of citation impact of publications

	Scientific Area	Share in world output	Share of international co-publications	Citation Impact Difference with EU28	8-year trend
High publication output	Medicine: General Medicine	3,0%	42%	+0.9	–
	Earth and Planetary Sciences: Geology	4,7%	69%	+0.74	–
	Chemical Engineering: General Chemical Engineering	1,9%	49%	+0.72	–
	Environmental Science: Environmental Chemistry	3,3%	56%	+0.63	⬆
	Health Professions: Physical Therapy, Sports Therapy and Rehabilitation	7,9%	43%	+0.61	⬆
	Nursing: General Nursing	5,9%	27%	+0.56	⬆
	Medicine: Obstetrics and Gynecology	4,1%	36%	+0.56	–
	Medicine: Orthopedics and Sports Medicine	4,8%	50%	+0.54	⬆
	Medicine: Pediatrics, Perinatology and Child Health	3,5%	37%	+0.53	–
	Medicine: Endocrinology, Diabetes and Metabolism	3,8%	47%	+0.51	–
Low publication output	Earth and Planetary Sciences: Economic Geology	5,7%	73%	+1.78	⬆
	Arts and Humanities: Archeology (arts and humanities)	3,2%	42%	+1.76	⬆
	Chemical Engineering: Chemical Engineering (miscellaneous)	1,5%	53%	+1.63	⬆
	Nursing: Maternity and Midwifery	6,8%	22%	+1.52	⬆
	Arts and Humanities: Conservation	1,9%	22%	+1.13	–
	Arts and Humanities: Museology	5,1%	16%	+1.1	⬆
	Arts and Humanities: Classics	1,9%	1%	+1.06	–
	Social Sciences: Archeology	3,5%	42%	+0.99	–
	Nursing: Community and Home Care	7,1%	20%	+0.95	⬇
	Nursing: Critical Care Nursing	3,3%	22%	+0.87	–

Source: DG Research and Innovation – International Cooperation
Data: Elsevier SciVal; extraction date: 6/8/2017; publications' window: 2011-2013; citations' window: 3 years
Note: These tables show scientific areas in which the country's academic publications have a higher citation impact than EU28, and whether this difference has decreased, increased or remained the same in the past 8 years. They are grouped in two tables. The top table focuses on areas with high share of publications in the country's total output of publications and the bottom table on those with low share of publications. Scientific areas are based on Elsevier 'All Science Journal Classification'. For each area, the country's share in the world output of publications and the share of international co-publications are also shown.

Figure 4: Australia – Specialisation compared to EU28 in selected technologies based on PCT patents

	Technology	2014 PCT patents	2014 PCT patents of EU28	2014 Specialisation compared to EU28	8-year trend
OECD classification	Nanotechnology	13	137	2,64	↑
	Medical technology	217	3.879	1,57	↓
	Pharmaceuticals	138	2.524	1,53	↑
	Biotechnology	144	2.745	1,46	↓
	ICT	620	14.579	1,19	↑
	Selected environment-related technologies	108	3.663	0,82	↓
WIPO classification	IT methods for management	95	425	6,51	↑
	Furniture, games	88	952	2,69	↑
	Civil engineering	137	1.632	2,44	↑
	Micro-structural and nano-technology	6	86	2,03	↓
	Computer technology	97	1.762	1,60	↑
	Medical technology	154	2.801	1,60	–
	Pharmaceuticals	85	1.581	1,57	↑
	Analysis of biological materials	18	426	1,23	↓
	Audio-visual technology	32	761	1,22	↑
	Other consumer goods	48	1.238	1,13	–
	Telecommunications	28	749	1,09	↑
	Control	29	784	1,08	–
	Biotechnology	50	1.400	1,04	↓

Source: DG Research and Innovation – International Cooperation
Data: OECD (top table) WIPO (bottom table); extraction date: 6/8/2017
Note: The top table shows the relative specialisation of the 2014 PCT patent output of the country with respect to EU28, calculated as (# of patents of country in technology X / # of patents of country in all technologies) / (# of patents of EU28 in technology X / # of patents of EU28 in all technologies). It also shows whether the relative specialisation has increased, decreased or remained the same in the past 8 years. The selected technologies are classified based on the OECD database. The bottom table shows the same information for the top-13 technologies with the highest specialisation index with respect to EU28 - this time the technology classification is based on the WIPO database. Both tables also show the country's and EU28 total number of PCT patents under each technology in 2014.