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Priorities for international cooperation in research and innovation

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**REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE
COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE
COMMITTEE OF THE REGIONS**

Implementation of the strategy for international cooperation in research and innovation

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Table of Contents

1. ENLARGEMENT AND EUROPEAN NEIGHBOURHOOD POLICY COUNTRIES.....	2
1.1. Enlargement Countries	2
1.2. Eastern Partnership Countries	4
1.3. Southern Neighbourhood Countries	7
2. INDUSTRIALISED COUNTRIES AND EMERGING ECONOMIES*	10
2.1. Australia	10
2.2. Brazil	13
2.3. Canada	16
2.4. China.....	19
2.5. India.....	23
2.6. Japan.....	25
2.7. Mexico.....	29
2.8. New Zealand.....	32
2.9. Republic of Korea.....	34
2.10. Russian Federation	37
2.11. United States.....	39
3. DEVELOPING COUNTRIES / REGIONS.....	42
3.1. South Africa.....	42
3.2. African Union.....	45
3.3. ASEAN.....	48
3.4. CELAC	50

* Presented in alphabetical order

1. ENLARGEMENT AND EUROPEAN NEIGHBOURHOOD POLICY COUNTRIES

1.1. Enlargement Countries

1.1.1. *The Enlargement Countries as partners of the EU*

Cooperation with the EU enlargement countries (currently six candidates and potential candidates from the Western Balkans¹ and Turkey) has focused on facilitating their integration into the European Research Area (ERA), inter alia through association to the EU Research and Innovation Framework Programme Horizon 2020.

The enlargement countries have, given their pre-accession status, a special place and importance for the EU with respect to research and innovation. All enlargement countries, except Kosovo², have signed association agreements to the Horizon 2020 programme and therefore contribute financially to it. Entities from Kosovo are, given their level of development, also eligible for funding.

Association to Horizon 2020 is the strongest form of cooperation offering entities established in the associated countries the same research and innovation opportunities as enjoyed by entities from the Member States. Through their association, the enlargement countries are also invited to nominate observers in the different Horizon 2020 programme committees allowing them to become familiar with EU decision-making. Representatives of the associated enlargement countries may also be invited to nominate observer delegates in ERA policy bodies such as ERAC. Given the pre-accession context, this aims at preparing these countries to take up effectively the EU acquis by the time they become a Member State.

Accession negotiations with Montenegro on the acquis on science, research and innovation (accession negotiations Chapter 25) were opened and provisionally closed in December 2012; accession negotiations with Serbia were opened in January 2014 and preparations on Chapter 25 are ongoing. With Turkey the accession Chapter 25 was opened and provisionally closed back in June 2006. Progress is being monitored on a regular basis in the annual report for all seven enlargement countries. This also allows the creation of synergies with funding under the Pre-Accession Instrument (IPA II). On the regional level, a Western Balkans Regional R&D Strategy for Innovation (with support from IPA), was adopted in Zagreb in October 2013 to encourage regional integration in a number of key areas. Under the EU Macro-Regional Strategies with respectively the Danube countries and the countries of the Adriatic and Ionian region, cooperation on research and innovation in a number of specific areas has also been included as a way to foster closer socio-economic relations and create growth and jobs. Finally, meetings with all West Balkan countries and regional stakeholders take place on a regular basis in the Steering Platform on Research to take stock and create synergies between the different actions and stakeholders aiming at strengthening regional integration and the R&I capacity in the Balkan region.

1.1.2. *Priorities for S&T cooperation*

The performance of enlargement countries in Horizon 2020 is quite heterogeneous and on average comparatively low. The best performing entities are those of Turkey (especially in the fields of energy, food and nanotechnology as well as participation in

¹ Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo, Montenegro and Serbia.

² This designation is without prejudice to position on status, and is in line with UN Security Council Resolution 1244/1999 in the International Court of Justice opinion on the Kosovo declaration of independence.

the SME instrument) and Serbia (mainly in ICT, energy and health). This relatively weak performance can be explained by several factors; in particular medium or low R&I capacity at national level, lack of comprehensive national research and innovation strategies and weak networks with EU researchers. Concentrating efforts on a number of selected research priorities is likely to help improving the research landscape in general and the participation in Horizon 2020 in particular. For example, the Western Balkans could benefit from focusing on research areas of common interest with partners from the Danube and Adriatic-Ionian EU macro-regions and engaging into a preparation of the Smart Specialisation Strategies. On the latter, expertise of the EC and in particular of the JRC in designing and implementing Smart Specialisation Strategies shall contribute to a better governance and coordination of the R&I activities and in turn to a better participation in the EU research programmes.

1.1.3. Framework conditions

As mentioned above, a substantial part of the cooperation with the Enlargement countries consists in preparing for compliance with the EU *acquis* on science, research and innovation. Having a good research and innovation capacity at national level and good framework conditions are likely, in turn, to increase their participation in Horizon 2020.

As of today none of the enlargement countries fully benefit from the ERA. To begin with, the level of investment in R&D is still very low to medium, ranging from 0.10% of GDP in Kosovo to 0.77% in Serbia and almost 0.96% in Turkey. In addition, the allocation of funding is not sufficiently competitive (ERA priority 1) and does not sufficiently set priorities in line with EU priorities aiming at concentrating efforts in addressing the societal challenges (ERA priority 2). Only Montenegro has a national roadmap for infrastructures in line with the ESFRI (European Strategic Forum on Research Infrastructures) Roadmap. Human capital availability is also weak³ and effective compliance with the Charter and Code of Conduct for recruitment principles is low (ERA priority 3). On gender equality, all countries are close to gender parity although women are still underrepresented in management functions. On open science and access to data, most Western Balkans are not fully aware of the principles of Open Access and/or lack the capacity to implement them. Some Turkish universities have started to implement open access to data but further efforts are necessary on Open Science skills such as on data management and re-use. With Turkey, the importance of acting in compliance with the ERA actions was discussed in October 2015 in a conference organised by the Commission together with six leading Turkish universities. Following this event, the six universities created an Alliance and made action plans on reform in the universities in line with the ERA actions. With the Western Balkans a Workshop on ERA actions was organised in March 2016.

Many of the countries are in the process of designing or updating a national strategy on science, research and innovation but several face the challenge to identify a clear vision and the knowledge and means to implement them. To streamline their efforts, the Commission's Policy Support Facility could help. At the same time, in the context of the Economic Reform Programme (ERP) process which was launched to prepare for the European Semester exercise, all enlargement countries have recognised that research and innovation are drivers of economic reform and competitiveness and plan for this purpose to deploy IPA II funding to strengthen their research and innovation capacity at national level.

³ In the West Balkan countries the number of R&D personnel in percentage of total employment (FTE) ranges between 0.13% and 0.60%. In Turkey the number is 0.45% (Unesco Institute of Statistics, 2013). The EU28 average for the same year is 1.26% (Eurostat).

1.2. Eastern Partnership Countries

1.2.1. *The Eastern Partnership Countries as partners of the EU*

The Eastern Partnership (EaP), launched at the Prague Summit of 7 May 2009, is a joint initiative of the EU and six Eastern European partner countries (Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova⁴ and Ukraine) that aims to bring Eastern European countries closer to the EU. At bilateral level, the EU is committed to building strong and mutually beneficial relations with all six partners, irrespective of their individual level of ambition in their relations with the EU. The Association Agreements/Deep and Comprehensive Free Trade Areas (AA/DCFTAs), concluded in 2014, have brought the relations between the EU and Georgia, Moldova and Ukraine to a new level. These agreements aim at strengthened political association and economic integration. They constitute a plan of reforms that will bring the partner countries closer to the EU by aligning their legislation and standards to those of the EU, and improve peoples' lives in a tangible way.

A more tailored approach to relations with Armenia, Azerbaijan and Belarus will help ensure the inclusive nature of the Eastern Partnership. A new agreement is being negotiated with Armenia, whose political and economic cooperation with the EU will take account of Armenia's other international commitments. The EU is also considering entering into a closer relationship with Azerbaijan, to better reflect our respective interests and values. For Belarus, the EU is deepening its critical engagement in carefully calibrated mutual steps.

The Eastern Partnership Riga Summit held in 2015 identified four main areas of cooperation between the EU and its partners, namely: strengthening of institutions and good governance; mobility and people to people contacts; taking advantage of market opportunities; and enhancing interconnections, notably in the areas of transport and energy.

In November 2015 the review of the European Neighbourhood Policy responded to changes and challenges in the neighbourhood, identified enhanced differentiation between and greater ownership by partner countries as key principles for future cooperation including in the context of the Eastern Partnership. This approach has overall been welcomed by all partners.

Besides the continuous bilateral and multilateral political dialogue, technical work is structured on four thematic platforms, whose work programmes 2014-2017 were revised in the beginning of 2016 to better reflect the current needs and priorities of the partners.

1.2.2. *Priorities for S&T cooperation*

Two fields of intervention have been identified as priority areas for cooperation in research and innovation with EaP countries: common societal challenges to focus on, and cross-cutting issues to address as priorities in order to improve the cooperation framework conditions. This priority setting was based on contributions received from EU Member States and EaP countries that were consolidated by an expert group mandated by the EaP Panel on Research and Innovation⁵.

⁴ Hereafter referred to as Moldova.

⁵ The EaP panel on research and innovation gathers senior officials from both EU and EaP countries and is attached to the EaP platform 4 "contacts between people" addressing bi-regional cooperation in the fields of education, youth, culture, ICT, research and innovation.

Collaborative research and innovation activities should concentrate on health, demographic change and well-being (e.g. through multilateral cooperation such as the Global Collaboration for Infectious Disease Preparedness), climate action and environment, and secure, clean and efficient energy.

Although a challenge-based approach is proposed, particular attention should also be given to cooperation activities on key enabling technologies listed in Horizon 2020 with particular focus on ICT, nanotechnologies, new materials, and space.

In order to identify more precisely the topics of mutual interest in the three societal challenges prioritised by the EaP Panel, a series of thematic policy stakeholders conferences and brokerage events have been organised⁶. In parallel, a number of ongoing regional FP7 projects⁷ are currently assessing framework conditions for cooperation in the field of innovation and analysing opportunities and challenges for research-industry partnerships across the two regions. The status of these projects was presented during the last EaP Panel meeting in March 2015, and working on the challenges ahead was identified as a priority, notably related to technology transfer issues.

Awareness raising and training events on smart specialisation can pave the way for better streamlined collaboration in the priority areas of research and innovation.

1.2.3. Framework conditions

Three out of the six EaP countries – Moldova, Ukraine and Georgia – are already associated to Horizon 2020. The association of Armenia is expected to become effective soon.

These associations are major steps forward in the improvement of framework conditions for cooperation with the EU. As an example, Moldova and Ukraine requested support from the Policy Support Facility in order to review and increase the competitiveness of their national research and innovation system and make them further compatible with the EU. A peer review of the Moldovan national research and innovation system was launched in November 2015 through the Policy Support Facility. The same exercise was launched for Ukraine during March-September 2016.

In order to further improve framework conditions, the cross-cutting priorities on which the efforts should be concentrated include sharing best practice between EU Member States and EaP countries in research and innovation management and establishing a regional evaluation platform, providing technical assistance and training to support EaP countries in improving their national research and innovation systems, promoting researcher mobility and common use of research infrastructures, notably through the creation of a regional network of Centres of Excellence (a new initiative, EaPConnect, to develop a regional EaP Research and Education Network and its interconnection to GEANT was launched in June 2015), and promoting the link between EU research-intensive clusters and technology platforms with similar structures in EaP countries, in order to enhance the participation of EaP countries' private companies in these structures.

Smart specialisation can serve as a horizontal topic for capacity building actions, improving prioritisation, stakeholder involvement, governance, and outwards dimension of R&I strategies. A Smart Specialisation Strategies Design & Learning Workshop was organised in Chisinau, Moldova, in February 2016, and similar awareness raising events will take place in Kiev, Ukraine and Belgrade, Serbia. These events will be followed up with tailor-made capacity-building trainings.

⁶ <http://www.inco-eap.net>

⁷ https://ener2i.eu/related_projects/r2i_cluster_east

As far as broader framework conditions for cooperation are concerned, these are mostly relevant to bilateral relations with EaP countries rather than at a regional level. Issues such as the protection of intellectual property rights, competition rules or the liberalisation of public procurement are indeed addressed in bilateral association or cooperation agreements that the EU has established individually.

1.3. Southern Neighbourhood Countries

1.3.1. *The Southern Neighbourhood Countries⁸ as partners of the EU*

The EU response to the changes in the Arab world was articulated in 2011 when the EU offered its Mediterranean partners 'A Partnership for democracy and shared prosperity' in the context of the European Neighbourhood Policy. The partnership focuses on three elements: democratic transformation, a partnership with people and civil society, and sustainable and inclusive growth. With regard especially to the last of the above elements, the EU has launched a number of initiatives with its Southern neighbours in the sphere of research, technological development and innovation.

Research and innovation play a crucial role in ensuring sustainable and inclusive growth and science diplomacy is a key tool within the region to address pressing societal challenges that are common across the Mediterranean. As a result, the EU's regional policy in research and innovation cooperation focusses on identifying joint cooperation priorities in order to align, integrate and step up efforts in science as a means to address large-scale and long term challenges.

Important developments have recently been recorded in the region, such as the association of Tunisia to the Horizon 2020 programme. Tunisian research institutes, universities and individual researchers will now have access to all opportunities offered by Horizon 2020. Tunisian SMEs and businesses will also be able to benefit from increased support to develop new ideas and bring products and services to the market.

These achievements also result from effective synergies between EU Research and Neighbourhood policies and instruments in addressing the region's needs in terms of strengthening local scientific and technological capacities and contributing to the emergence of an innovation-friendly environment. These links are crucial to enable the region to be in a position to fully benefit from its cooperation in research and innovation with the EU; they should be pursued and enhanced further in the future.

1.3.2. *Priorities for S&T cooperation*

A comprehensive approach is envisaged in the area of migration that could encompass broadly related drivers for long-term migratory trends including climate change and sustainable development, but also other areas such as relief and aid-related actions, crisis and disaster management and societal reintegration of displaced populations.

In this context, the link between water provision and food security is a challenge of primary concern to EU-Southern Neighbourhood cooperation, exacerbated by climate change. As a result, water resources and food systems are the cornerstone of the PRIMA⁹ proposal. With this initiative from the Participating States, the EU and the Southern

⁸ Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestinian Authority, Syria, Tunisia.

⁹ The "Partnership for Research and Innovation in the Mediterranean Area" (PRIMA) is a proposal for the participation of the Union in a joint research and innovation programme, through Article 185 TFEU, submitted by nine EU Member States on 22 December 2014, following adoption of Conclusions by the Council on 5 December 2014. The proposal focuses on the development and application of innovative solutions for food systems and water resources in the Mediterranean basin.

Mediterranean are expected to take steps to align and integrate joint research and innovation priorities by seeking more structured cooperation. The Commission proposal for the participation of the Union in the proposal for a joint programme under Article 185 TFEU to be supported by Horizon 2020, with a view to establishing EU-Mediterranean cooperation at a sufficient scale is in its final stage. In parallel, the process is advancing for the conclusion of international agreements with third countries not associated to Horizon 2020 to allow for their participation in PRIMA. Meanwhile, a dedicated coordinated and support action is foreseen in 2016 in support of the work towards a jointly designed Strategic Research Agenda with appropriate governance and implementation structures.

Marine environment and resources efforts will be directed to research and innovation actions addressing the observation and mapping of the Mediterranean basin. Coordination and support actions in backing the BLUEMED initiative as well as demonstration projects aimed at developing and scaling innovative processes and measures for coast and sea clean-up will be deployed.

In the area of violent radicalism and religious fundamentalism, Horizon 2020 will support research and innovation actions that seek to enhance the knowledge base about scope, origins and root causes of radicalisation. The influence of sustained inequalities and discrimination will also be addressed with a view to supporting policy development in these areas and favouring de-radicalisation.

In the area of security research, the Commission is promoting reinforced cooperation with the Mediterranean region in the context of the Horizon 2020 Secure Societies Work Programme (WP) 2016-2017. With the aim to enable a joint network concept for border protection and other security and disaster-related tasks, entities shall share information, collaborate better, and establish joint border surveillance scenarios.

The EU will support staff exchanges amongst SESAME, the Synchrotron-light for Experimental Science and Applications in the Middle East. It will also upkeep the European Light Source Infrastructures through a dedicated coordination and support action that will be launched at the end of 2016.

Transport cooperation currently focusses on the area of port and hinterland connectivity amongst other infrastructure-related themes. Planned research and innovation actions will address the design, engineering, construction and operational technologies solutions in the design of ports and wider ports. Support actions focusing on the identification of key performance indicators, monitoring and evaluation mechanisms linked to port infrastructures will also be launched.

As an input to the EU's commitment in implementing the Paris Agreement as a follow-up to COP21, the EU and the Southern Mediterranean have also agreed to pursue cooperation in the area of renewable energies, possibly in solar energy as well as in wind power and Mediterranean-specific biomass as a means to meet significant forecast increases in energy demands in the region while transitioning to low-carbon energy and improving energy security and efficiency.

In the area of health, potential areas for cooperation include rare and infectious diseases, and non-communicable diseases such as diabetes, cancer and obesity. A number of multi-lateral initiatives including the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) and the Global Alliance for Chronic Diseases (GACD) may provide the right setting for cooperation with Southern Mediterranean countries. Egypt has expressed interest in GACD and other countries from the Southern Mediterranean may follow.

In the area of seismology, the need to improve knowledge on data, methods, and seismic hazard assessments, in order to better quantify the uncertainties in the region, has been identified.

1.3.3. Framework conditions

Framework conditions are mostly relevant to bilateral aspects of cooperation with Southern Mediterranean countries rather than at regional level. Issues such as the protection of intellectual property rights, competition rules or the liberalisation of public procurement are addressed in bilateral association agreements that the EU has established with Southern Mediterranean countries.

While mutual access to research and innovation programmes may still need some improvement, progress has been made in opening national research programmes in Southern Mediterranean countries to European researchers. For example in Morocco, a 2013 call for scientific projects funded by the National Support Fund for Scientific Research and Technological Development was open to non-Moroccan researchers and attracted applications involving 153 foreign institutions from a total of 396 proposals.

2. INDUSTRIALISED COUNTRIES AND EMERGING ECONOMIES¹⁰

2.1. Australia

2.1.1. *Australia as a partner of the EU*

The EU and Australia established diplomatic links in 1952 and have upgraded their relationship along the years through successive agreements in key areas of political, trade and security cooperation, including development aid, education, research and innovation.

The Framework Agreement to be signed by the two parties in 2016 clearly identifies science and innovation as key areas for developing relations.

The EU is presently the largest source of foreign direct investment in Australia and also the second largest destination of Australia's direct investment abroad. Furthermore, the EU and Australia have commenced work towards the launch of negotiations for a Free Trade Agreement in order to remove existing market access barriers for goods, services, investment and public procurement.

2.1.2. *Priorities for S&T cooperation*

The Joint Science and Technology Consultation Committee (JSTCC) meeting of December 2014 stressed the need to deepen and scale up cooperation in selected thematic areas.

In bioeconomy, the parties agreed to consider the expansion of the International Knowledge-Based Bio-Economy Forum into the International Bio-Economy Forum.

In research infrastructures, strategic areas of collaboration where regular workshops and exchanges have already been taking place, are identified in bio-molecular technologies, bio-diversity, marine data, material science, physics (synchrotrons and neutron sources), research data management and e-infrastructures (networking, grids, computing). In radio-astronomy, Australia will host one of the two pillars of the Square Kilometer Array currently supported through Horizon 2020 as one of the (international) flagship initiatives in the European Roadmap for Research Infrastructures developed by the European Strategy Forum for Research Infrastructures (ESFRI). The publication of the 2016 ESFRI roadmap provides a number of additional opportunities for collaboration which should be explored.

Australia and the EU cooperate in multilateral initiatives aimed at addressing health challenges, including the International Rare Diseases Research Consortium (IRDiRC), the Global Alliance for Chronic Diseases (GACD) and the Global Research Collaboration for Infectious Diseases Preparedness (GloPID-R). Furthermore, both Australia and the EU are members of the Human Frontier Science Programme (HFSP). Also, Australia participates as a third country member of the Joint Programming Initiative on Neurodegenerative Disease Research and continues its Associate Membership in the European Molecular Biology Laboratory.

Beyond the priorities identified in the JSTCC, there is increasing demand in the area of resource efficiency and raw materials and a pressing global need for strategic international dialogue and cooperation both with producers and technologically advanced countries. Australia is an important partner in the International Raw Materials Observatory which aims to promote cooperation with technologically advanced countries and facilitate global discussion.

¹⁰ Presented in alphabetical order.

Sustainable cities are the focus of on-going EU initiatives and Australia's new 'Agenda for cities'. Cooperation could be enhanced through the Belmont Forum or the Future Earth programme. Possible future cooperation in Nature-Based Solutions for disaster risk reduction could also be investigated.

Further to the Intergovernmental Panel on Climate Change (IPCC) findings on the pressing need for a 'whole of ocean' strategy, research on ocean strategy and governance could be developed to enhance ocean economy, climate science and climate action in the framework of the EU blue growth strategy¹¹ and Australia's "Vision in Blue" ten-year plan for science¹². A new Horizon 2020 project called 'MESOPP' (2016-2019) developing e-research infrastructures linked to ocean research has been launched by a consortium of eight European and Australian partners.

In November 2015, the Commission and the Australian government signed a Memorandum of Understanding to cooperate on Earth Observations through the Copernicus programme's full, free and open data policy. The availability of this satellite data will stimulate the development of digital products and services, create business opportunities, encourage cutting-edge research and improve public policy making. This agreement complements a June 2015 Memorandum of Understanding on cooperation between the European Space Agency (ESA) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to give Australia better access to information from Europe's Earth-observing satellites, while ESA will benefit from Australia's scientific expertise.

The Commission will continue to explore further avenues of cooperation and priority-setting taking into account the new Australian National Innovation and Science Agenda¹³ and Australia's plans to invest \$A2.3 (€1.6) billion over the next 10 years in cutting-edge national research infrastructure through the National Collaborative Research Infrastructure Strategy¹⁴, the Australian Synchrotron and Australia's commitment to the Square Kilometre Array.

Australia's Global Innovation Strategy is expected to offer opportunities for European industry-academia and SME collaboration in innovation-driven sectors.

The initiative "Innovation in agriculture and regional areas" in the framework of the Australian National Innovation and Science Agenda will support Regional Development Agencies across the country in pursuing economic development opportunities through smart specialisation, following the European Commission's approach. The Hunter region has been the first Australian region to launch a smart specialisation strategy (S3) in 2016. The S3 Platform of the European Commission's Joint Research Centre has been involved in a number of interactions with Australian authorities and academic institutions in order to explain and promote the smart specialisation approach and will continue to engage in such activities. The institutions involved are in particular the Regional Economic Policy Branch of the Department of Infrastructure and Regional Development of the Australian Government and the EU Centre at the RMIT University of Melbourne.

¹¹ http://ec.europa.eu/maritimeaffairs/policy/blue_growth/index_en.htm

¹² http://www.aims.gov.au/docs/media/latest-news/-/asset_publisher/EnA5gMcJvXjd/content/11-august-a-vision-in-blue-ten-year-plan-for-science-helping-drive-australia-s-growing-blue-economy

¹³ <http://www.innovation.gov.au/>

¹⁴ In 2016, Australia's Chief Scientist will chair an expert group to undertake a collaboration and road-mapping process to identify specific future research infrastructure capability requirements.

2.1.3. Framework Conditions

Framework conditions for cooperation between Australia and the EU are very good as Australia enjoys a strong legal framework in STI, including intellectual property rights protection and open access to data.

Within the field of health research, Australia is providing support to Australian researchers participating in Societal Challenge 1: 'Health, demographic change & wellbeing' of Horizon 2020. The National Health and Medical Research Council has put in place a procedure that identifies priority Horizon 2020 WP topics and commits to provide funding to Australian participants within their available budget. A similar procedure would be desirable with the Australian Research Council. The Australian Research Council and the European Research Council are also exploring possible bilateral agreements in terms of researcher mobility.

2.2. Brazil

2.2.1. *Brazil as a partner of the EU*

The EU and Brazil have had a Strategic Partnership since 2007 and a bilateral Science and Technology Agreement which was signed in 2004, entered into force in 2007 and renewed in 2012 for 5 more years. A Cooperation Arrangement under the existing bilateral Agreement was signed on 24 January 2013 in Brasília between the Joint Research Centre (JRC) and the Brazilian Ministry of Science, Technology and Innovation (MCTI). In the area of Fusion Energy Research, a bilateral Cooperation Agreement under the Euratom Treaty, was signed in 2009 and entered into force in 2013. Brazil is one of the first non-ITER parties with which Euratom has signed a bilateral fusion cooperation agreement.

The importance of cooperation on research and innovation in addressing the shared economic, environmental and societal challenges within the context of overall EU-Brazil relations was reiterated at the EU-Brazil Summit of February 2014.

Brazil has made significant advances in its Science, Technology and Innovation policy, which has contributed to the institutional strengthening of the STI System. This has included an improvement in number and qualification of human resources as well as in R&D infrastructure. Brazil remains at the frontier of research in the field of agriculture as well as in tropical and infectious diseases. It is also a world-class player in the fields of ICT, nanotechnologies and energy and it hosts some of the top universities of Latin America. Its potential as a research and innovation partner therefore continues to grow.

2.2.2. *Priorities for S&T cooperation*

The Joint Steering Committee (JSC) which oversees the implementation of the EU-Brazil S&T Agreement has emphasised the need to deepen, scale up and open cooperation in selected thematic areas. This has led to a number of initiatives:

Marine research is one of the main developing areas of joint interest. In November 2015, European Commissioner Carlos Moedas signed a Declaration of Intent with the Brazilian Minister of Science, Research and Innovation to enhance marine research cooperation. The topics identified include ocean observation and forecasting systems, food security (including aquaculture), ocean technology, ocean literacy, land-sea interactions and polar research. In parallel, Brazil and South Africa signed a joint document on South-South Atlantic research cooperation aiming at developing a South Atlantic Science Plan. This initiative will match the Science Plan that has been developed for the North Atlantic together with the US and Canada. This contributes to increase cooperation with the South Atlantic countries towards an All Atlantic Ocean Research Alliance.

In the area of bioeconomy and agriculture, the EU is considering keeping a multilateral approach involving the key states all over the world. Brazil has been invited to become a member of the International Bioeconomy Forum which would create a multilateral platform for discussion and action on the bioeconomy and which will be established in the second half of 2016. In the area of biotechnology, a Biotechnology Observatory in Brazil has been funded by the Sector Dialogue Facility supported by the Commission mirroring the EU Bioeconomy Observatory managed by the EU's Joint Research Centre. This is a good example of leveraging other funding mechanisms to support infrastructure that enables or facilitates S&T cooperation. Furthermore, there is ongoing cooperation through the Sector dialogues facility in the field of Alternative Methods to animal use and Agroecology Platforms.

In the field of energy, advanced biofuels is the topic of a coordinated call in the WP 2016-17 of Horizon 2020 which aims at exploiting synergies between Brazil and Europe in terms of scientific expertise and resources in this area. Joint work can build upon the Brazilian sugarcane ethanol model and should benefit from the Brazilian and European experience in biofuels. In the coming years, Brazil will be an important partner in the context of Mission Innovation¹⁵.

Progress is also being achieved in the cooperation on the domain of nanosafety through Brazilian participation in the EU project NanoReg (A common European approach to the regulatory testing of Manufactured Nanomaterials). In the future, it is intended to broaden this cooperation to other nanotechnology areas.

In the area of health, a dedicated Horizon 2020 call on ZIKA was launched in March 2016 to set up a research network across the Latin America region to facilitate, coordinate and implement urgent research to combat the ZIKA outbreak, and lay the foundation for a preparedness research network against any future emerging severe infectious threats. Given the seriousness of the outbreak in Brazil and the risks associated to its spreading in the region and globally, on an exceptional basis, Brazilian scientists participating to the selected project(s) will be funded by the EU.

Brazil is active in high-speed aerospace and aviation technologies and an active partner in EU projects including as a supplier of rocket stages¹⁶ and participation in projects on alternative fuels for aviation.

In the area of environment, Brazil became a member of the Belmont Forum in 2012 and cooperation is being explored in the area of sustainable urbanization, with focus on 'sustainable and re-naturing cities' and on the building of a platform of technologies inspired by nature. The Research Foundation of the State of São Paulo (FAPESP) is a member of Belmont Forum and will take over the co-presidency as of January 2016.

ICT is another prominent cooperation area with Brazil. The three coordinated calls funded jointly by Brazil and the EU implemented so far, will be followed by a fourth joint call under the LEIT-ICT part of WP 2016-17 of Horizon 2020, addressing the areas of 5G, Cloud Computing and IoT Pilots. Further cooperation priorities go beyond the current research areas - Next Generation Internet, building on FIWARE collaboration. In addition to this, regular EU-Brazil ICT Dialogues were established on an annual basis to discuss ICT policies, especially in domains related to the research and innovation topics addressed in the coordinated/joint calls.

In the field of research infrastructures, cooperation with Brazil is explicitly foreseen in the area of biodiversity and carbon cycle in particular in connection with the LIFEWATCH ESFRI project (on the ESFRI roadmap since 2006). A relevant initiative which could positively impact is the Trans-Atlantic submarine cable for connectivity to Latin America, aimed at ensuring very high capacity, cost benefit, short route and stimulating diversity over the trans-Atlantic segment. The Commission will also support a group of public actors gathered in the consortium BELLA (Building European Link to Latin America)¹⁷.

The development of regional innovation systems is considered by the Brazilian National Plan for Regional Development - PNDR (2011) as a priority for social-economic

¹⁵ <http://mission-innovation.net/>

¹⁶ http://www.esa.int/Our_Activities/Space_Engineering_Technology/High-Speed_Experimental_Fly_Vehicles_-_INTERNATIONAL

¹⁷ <https://ec.europa.eu/digital-single-market/en/news/planned-new-submarine-cable-between-europe-and-latin-america-joint-venture-agreement-signed>

development. In this context, the North-west region of Brazil (in particular the state of Pernambuco) is being jointly analysed by the European Commission and the Brazilian MI - Ministério da Integração Nacional, CGEE – the Center for Strategic Studies and Management Science, Technology and Innovation, and SECTI/PE – the Secretaria de Estado de Ciência Tecnologia e Inovação do Estado de Pernambuco.¹⁸ This cooperation experience offers unique conditions for piloting the adaptation of the European Smart Specialisation Strategy approach to the Brazilian context.

2.2.3. *Framework Conditions*

Framework conditions for research cooperation with Brazil have been improving over the last decade. The government adopted two consecutive National Science, Technology and Innovation Strategies, whose key elements included an improved innovation regulatory framework, a larger and more accessible funding structure and international cooperation. The setup of a co-funding scheme by the Research Foundation of the State of São Paulo (FAPESP) and by the Brazilian National Council of Research Foundations (Confap) will provide Brazilian researchers with funding sources to support their participation in Horizon 2020 projects. The nomination of a National Contact Point for Horizon 2020 at the University of São Paulo is also an important step to facilitate Brazilian participation in Horizon 2020.

EU-Brazil cooperation will also be strengthened by supporting two-way mobility of researchers and academic staff. There are ongoing discussions for an Implementing Arrangement between Brazilian institutions and the European Research Council. Additionally, Confap has recently been nominated a National Contact Point for the Marie Skłodowska-Curie Actions with the objective of providing targeted assistance to Brazilian researchers interested in working for limited periods in the EU.

¹⁸ The project builds on a previous preparatory action that was supported by the EU-Brazil sectoral dialogues Support Facility (Projeto Apoio aos diálogos setoriais Uniao Europeia – Brasil) and made a proposal of terms of reference to support the development of the regional innovation system of Pernambuco.

2.3. Canada

2.3.1. *Canada as a partner of the EU*

Canada is one of the EU's long standing and closest partners, diplomatic relations having started formally in 1976. The recent political breakthroughs on the Comprehensive Economic and Trade Agreement (CETA) and the Strategic Partnership Agreement (SPA) will further enhance this strong relationship. The ambitious SPA, which was initialed in September 2014 in Ottawa, will provide an overall upgrade and an umbrella for the bilateral relations. It will replace the 1976 Framework Agreement with a modern Treaty reflecting the major developments within the European Union over the last decades. SPA will reinforce cooperation in such strategic areas as international peace and security, human rights, environment, research, innovation, energy security and education.

The European Union and Canada also cooperate actively on various Arctic issues.

Canada is one of the world's five largest energy producers and has benefitted from the revolution in unconventional oil and gas production. The new Canadian government is putting more emphasis on environment and climate and at the COP 21, Canada was particularly active in helping to secure a robust and ambitious outcome not least by supporting the 1.5°C target.

Canada has a well-established and strong post-secondary education system and benefits from some world-class university research. As a result health and medical research as well as physics and psychology are extremely strong scientific areas. Strengths in industrial research can be found for example in aeronautics, ICT or oil and gas extraction.

The Agreement for Scientific and Technological Cooperation between Canada and the European Union has been in place since 1996.

2.3.2. *Priorities for S&T cooperation*

EU-Canada marine science cooperation is moving from strategic planning to implementation of priority activities in the form of large and concrete research projects since the beginning of Horizon 2020. The trilateral marine working group EU-Canada-US is exploring opportunities to strengthen industry engagement with the Galway initiative on Atlantic Ocean Cooperation¹⁹. It is also working on increasing the coordination with the Canada-EU Arctic Working Group and developing concrete milestones for implementation of the Galway initiative, including alignment of programmes and funding.

The Horizon 2020 WP 2016-17 included an "arctic package" of two project calls for 2016 and one project call for 2017 under the 'Blue Growth' call, inviting all proposers to consider Canadian and US participation. EU funding for this package is in the order of 40 million €.

Big-data, research data and cyber-security have been identified as potential areas for future cooperation under ICT.

Concerning health research, both the EU and Canada continue to be jointly involved in all the multilateral research initiatives that the EU has either started or joined. Some of them are the International Rare Diseases Research Consortium (IRDiRC), the Global Alliance for Chronic Diseases (GACD), the International Human Epigenome Consortium

¹⁹ https://ec.europa.eu/research/iscp/pdf/galway_statement_atlantic_ocean_cooperation.pdf

(IHEC) or the International Initiative for Traumatic Brain Injury Research (InTBIR). Moreover, both Canada and the EU are members of the Human Frontier Science Programme (HFSP). Last but not least, Canada continues to invest in several Joint Programming initiatives such as the Joint Programming on Neurodegenerative Diseases²⁰ and the Joint Programming Initiative on Anti-Microbial Resistance²¹. Furthermore, funding agencies from Canada participate in the E-Rare-3 ERA-NET which coordinates research programmes on rare diseases²².

A specific energy research call in the 2017 WP of H2020 will provide European and North American (both Canada and US) researchers, industry and policymakers with a platform to enhance and deepen transatlantic dialogue on environmental issues related to Carbon Capture and Storage and unconventional hydrocarbons development. It is expected to accelerate learning and provide advanced training. Connecting pilots and projects across the Atlantic should bring the benefits of cross-validation of technologies, sharing results, distributing tasks, bundling expertise and expanding professional networks.

The possibility of launching a second coordinated Horizon 2020 call in the aeronautics area (to follow up the successful one in 2014/15) is being investigated.

Collaboration between Europe and Canada in the domain of Research Infrastructures is highly important. Increased cooperation on marine and Arctic Research Infrastructures (interoperability, data management, better use and access, funding strategy, innovation and links with industry) is planned.

In this context, the EC may facilitate links between the Canadian High Arctic Research Station and the Svalbard Integrated Arctic Earth Observing System²³, a project on the European Roadmap for Research Infrastructure development (the ESFRI roadmap).

2.3.3. *Framework Conditions*

The Canadian government has indicated that Canadian governmental services will explore ways to expand the cooperation fields beyond the areas mentioned above. High on the cooperation agenda are topics like environment and climate change related research as well as energy research.

European and Canadian programme owners and managers are preparing for more programme level cooperation and exploring how Canadians and Europeans may partner under existing frameworks/joint programmes to better align the respective funding streams. This programme level cooperation exchange involves the major Canadian Granting Councils at federal level as well as the relevant provincial authorities.

While there is no federal matching fund in Canada concerning Horizon 2020, there seems to be a growing interest in the provinces to use provincial funding programmes to support Canadian participants in Horizon 2020 projects. For example researchers from Quebec can apply for funding through a programme for international cooperation: "Programme de soutien à la recherche (PSR)- Soutien à des initiatives internationales de recherche et d'innovation (SIIRI)".

Canada has established a strong network of National Contact Points for Horizon 2020 in the main areas for cooperation so the basic information and conditions for cooperation are well known and disseminated.

²⁰ www.neurodegenerationresearch.eu

²¹ www.jpamr.eu

²² <http://www.erare.eu/>

²³ <http://www.sios-svalbard.org/>

Canadian Granting Councils and in particular the Canadian Institute for Health Research (CIHR) are well integrated in the European research landscape. Under the Horizon 2020 Societal Challenge 1 WP 2016-2017, CIHR decided to support the participation of Canadian research groups in one or more EU-funded projects selected under topic SC1-PM-01-2016 “Multi omics for personalised therapies addressing disease of the immune system” by launching a parallel funding opportunity.

2.4. China

2.4.1. *China as a partner of the EU*

China is a long standing key partner country on research and innovation cooperation for the European Union. The relationship is governed by the Science & Technology Cooperation Agreement signed in December 1998 and last renewed in December 2014. In addition an Agreement between the European Atomic Energy Community (Euratom) and the Government of the People's Republic of China for R&D Cooperation in the Peaceful Uses of Nuclear Energy (RD-PUNE) is in place since 2008. A new High Level Innovation Cooperation Dialogue (ICD) was inaugurated in 2013 raising the level and intensity of research and innovation relations with China.

China is the world's third largest economy after the EU and the US and the second biggest trader after the EU. China is moving fast towards a knowledge-based and innovation-driven economy. China invests over 2% of GDP in research and development, is the world's third largest publisher of research, and vigorously promotes innovation policies. The EU, as a world leader in this area, has a strong interest in working with China to promote scientific excellence, address global societal challenges and promote business and investment opportunities in China for European undertakings. Since 2015 China is reforming the National S&T Programme Management to streamline numerous state-funded scientific and technological funds and further increase effectiveness of R&D spending.

2.4.2. *Priorities for S&T cooperation*

While STI cooperation with China is bound to be continued and increased across the board, the following areas have been identified as priority deserving dedicated actions.

The EU and China are two of the biggest trading partners and food producers in the world, and face many similar nutrition and food security challenges. The overall challenge is to ensure sustainability of the agri-food systems catering for the needs of the growing population (especially in cities), the reduction of food and agricultural losses and waste, and the provision of safe and healthy foodstuffs. The flagship initiative on Food, Agriculture and Biotechnology (FAB) launched in 2013 is bound to be continued and reinforced with a view to identify sustainable solutions for those challenges with a farm-to-fork approach. On the bioeconomy area, China has been also invited to become a member of the International Bioeconomy Forum.

Sustainable urbanisation is a major socio-economic challenge for both China and Europe and has been recognised by both sides, as well as by Member States, as a priority area for research and innovation cooperation. Future cooperation will be pursued by promoting support for large scale demonstration projects on the deployment of nature and cultural heritage based solutions is likely to continue with a view to address the numerous challenges that cities are facing such as air and noise pollution, human health, natural disasters, biodiversity loss, degradation of natural capital and the ever increasing urbanisation trends.

The rapidly evolving high-tech aviation sector is of mutual interest for Europe and China. Building on the experience of past successful coordinated calls for proposals with the Ministry of Industry and Information Technology (MIIT), policy dialogue and cooperation with MIIT is bound to continue. Future cooperation on aviation research will involve the close monitoring of the on-going projects and the identification of priorities

for future joint actions through stakeholders' consultation taking into account the findings of the GRAIN2 joint project on green technology in aviation.

China is a strategic partner for the EU in energy research and innovation for a number of reasons including the size of the Chinese market, the effort made by China to increase RD&D (Research, Development and Demonstration) spending and the recent commitment taken regarding the transition to low carbon economy. China is one of the principal interlocutors on peaceful use of nuclear energy research for Euratom Agreement. Future cooperation on fission energy research will be strengthened with the completion of the ALISA project, increased Chinese participation in Euratom and exchanging programmatic S&T expertise. On fusion energy research the two sides will pursue the agreed priorities under the bilateral Fusion WP 2013-2020. With regard to non-nuclear energy, building on the statement DG RTD signed with MOST in 2010 and on the successful cooperation on NZEC dialogue, cooperation will be stepped up with particular regard to renewable energy and energy efficiency.

Considering the aim of the Paris Conference of the Parties (COP21) for more stringent commitments to reduce global greenhouse gas emissions, both the EU and China committed at the Summit and Innovation Cooperation Dialogue of June 2015 to enhance their collaboration on climate-related scientific research and technology innovation, including the development and deployment of low-carbon technologies and adaptation solutions that can contribute to international efforts to combat global warming.

In the field of environment, water is a priority for cooperation with China. The Commission has been supporting the China-Europe Water Platform²⁴ and will continue to promote policy dialogue, joint research and business development in the water sector.

Biomaterials and their eventual applications into industrial technologies for healthcare are a priority area for the EU and for China. China excels in materials science. Building on the positive experience of the last coordinated call with the Natural Science Foundation of China (NSFC), cooperation on biomaterials and biotechnology is bound to be continued and reinforced.

Closer cooperation on ICT R&I with China will hinge on further progress towards openness of the Chinese research programmes in line with the Joint Declaration on Strategic Cooperation on 5G networks signed in September 2015. The key points are non-discriminatory access to China's RDI programmes for foreign-owned companies, transparent information and procedures, including the scope, the requirements, the selection of the projects, as well as clear intellectual property rights rules which are in line with global best practices. Cooperation could be enhanced through twinning EU-funded 5G-PPP projects and related China-funded 5G (mega) projects as well as twinning activities between IoT Large Scale Pilots and Megaprojects, with particular regard to Internet of Things architectures, test beds and platforms, semantic and technical interoperability, thus making full use of the knowledgebase and advantages of both regions. Joint development of international standards for the IoT business layer is also to be pursued.

Under the EU-ESA-China Dialogue on *Space Technology Cooperation* the EU and China are committed to further reinforcing research and innovation cooperation with particular regard to Satellite Navigation and Earth Observation. China is one of the four co-chairs of the Group on Earth Observation (GEO) implementing a Global Earth Observation System of Systems (GEOSS) and advocating full and open access to Earth observation data worldwide. The GEO Ministerial Summit of November 2015 extended GEO for

²⁴ <http://cewp.org/>

another 10 years for the period 2016-25 and adopted a new GEOSS strategic plan. Further collaboration with China could take place on the use of earth observation for the monitoring of urban environment and megacities and of the polar region, including enhanced research cooperation on big data.

Cooperation in health research is intended to be pursued in the framework of multilateral initiatives, in particular on the prevention and treatment of infectious diseases and in the area of traumatic brain injuries.

Dialogue on research infrastructures will be developed in order to identify future cooperation activities in particular in areas such as environmental and earth sciences, life sciences including food, agriculture and biotechnologies and virology, and material and analytical facilities with a view to define future joint actions.

EU-China relations should also be strengthened by supporting two-way mobility of researchers and academic staff. The recent agreement between the ERC and the Natural Science Foundation of China represent a valuable tool for promoting enhanced and more balanced mobility of researchers.

The Joint Research Centre will continue to support the implementation and development of various priority areas of research and innovation cooperation with China. Cooperation will be reinforced in areas where scientific knowledge needs to inform policies, such as global change, air quality, human settlement analysis, land and soil degradation, land cover mapping, agricultural monitoring and digital earth science. This will contribute to developing joint solutions to global challenges such as disaster risk reduction, sustainable development and urbanisation, and climate action.

While EU-China cooperation on collaborative research based on the S&T agreement in place since 1998 is long standing and spans a number of thematic areas, dialogue on innovation cooperation is very young. The high level Innovation Cooperation Dialogue inaugurated at the Summit in November 2013 achieved already concrete and important results but there is still a lot of untapped potential for future cooperation. Several areas are being considered for future development such as cooperation on Innovation and SMEs, Open Innovation, Innovation Platforms, Clusters and promotion of STI investment.

2.4.3. Framework Conditions

Having the right framework conditions in place is essential for strong and balanced EU-China S&T Cooperation and for making EU and China attractive global R&D players. A new co-funding mechanism (CFM) was agreed at the 2015 Summit and ICD and the Chinese Ministry of Science and Technology published the first CFM call for proposals in December 2015²⁵. Under the CFM, MOST allocates 200 million RMB, or about 28 million euros, annually to provide competitive funding to China-based entities participating in joint projects with European partners under Horizon 2020.

Protection and enforcement of intellectual property rights are crucial for the promotion of innovation. Dialogue and cooperation with China on these areas should be intensified. EU-China cooperation could also benefit from increased flexibility in visa policy, to facilitate international mobility for scientist exchanges at all levels, including experts as well as young talents.

Reciprocal access to respective STI funding programmes is being addressed in the ongoing reform of the Chinese STI funding system. The agreement on reciprocal access to

²⁵ See [MOST call](#) Chinese version - [MOST call](#) English translation.

respective STI funding programmes reached at the EU-China Joint Committee meeting opens the door to more cooperation opportunities although it requires close monitoring and fine tuning.

Standardisation is another key issue. It is in the interests of both China and the EU that all stakeholders participate in the standard definition process to enhance the competitiveness of Chinese-developed technology in the international market. Opening this process to all, including foreign companies, could be an excellent booster.

2.5. India

2.5.1. *India as a partner of the EU*

The EU-India Strategic Partnership was created in 2004 to enable the partners to better address international issues in the context of ever-increasing globalisation. Political cooperation covers a wide range of international concerns such as security, international political issues, energy, environment, and climate change. The EU and India have been negotiating an ambitious Free Trade Agreement since 2007.

India has embarked on a process of economic reform and progressive integration with the global economy that aims to put it on a path of rapid and sustained growth.

India's R&I landscape is however contrasted. On the one hand, the country has ramped up scientific production at an impressive rate. India has several world-class centres for science education, particularly the Indian Institutes of Technology. The country is also recently experiencing a surge in its share of the world's high-quality scientific publications²⁶. On the other, with only 200,000 full-time researchers and 17 patent applications per 1 million people, India has few scientists relative to its population size and it produces relatively few patents²⁷.

The outsourcing of knowledge-intensive activities to India has contributed to make the services sector the largest contributor to GDP (55%) and the presence of multinationals' R&D centres has accelerated India's integration in the global research system. In 2014 India had a research intensity of 0.85 % of GDP, contributing to 2.7% of the total global R&D spending. Only a third of the Indian investment in R&D is from the private sector. More than half of it relates to defence, space and nuclear sectors.

EU-India cooperation in several areas of R&I is increasing the ability of both sides to tackle global challenges more effectively.

2.5.2. *Priorities for S&T cooperation*

At the 2015 EU-India Joint Steering Committee meeting both sides agreed to continue and explore cooperation in the following areas: health, water, energy, smart cities, food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy, nanotechnologies, and advanced materials. These areas are in line with the political priorities provided by the EU-India Summit held in Brussels on 30 March 2016. On that occasion, the EU-India Agenda for Action 2020 was adopted and a number of joint declarations made, notably on an India-EU Water Partnership and on a Clean Energy and Climate Partnership.

On the bioeconomy area, India has been invited to become a member of the International Bioeconomy Forum which would create a multilateral platform for discussion and action on the bioeconomy and which will be established in the second half of 2016.

The EU and India cooperate well in the framework of the Global Alliance for Chronic Diseases (GACD). Since the EU joined (India was already a member), calls have been launched in areas such as type 2 diabetes and lung diseases. The next planned call is in the area of mental health. The EU encouraged Indian participation in health research within multi-lateral platforms such as the Global Research Collaboration for Infectious Disease Preparedness and the International Initiative for Traumatic Brain Injury. An important interlocutor on health research is the Department of Biotechnology (DBT),

²⁶ <http://www.natureindex.com/pdf/news/indian-science-ascending.pdf>

²⁷ <http://www.nature.com/news/india-by-the-numbers-1.17519>

which is willing to cooperate on anti-microbial resistance including the Joint Programming Initiative on Anti-Microbial Resistance²⁸. Reinforced cooperation in the area of Global Health is also envisaged as announced at the EU-India Summit of March 2016.

On fusion cooperation, both sides agreed at the second Euratom-India Coordinating Committee meeting, to share knowledge and understanding of the respective fusion programmes and strategic roadmaps, with ITER constituting the main benchmark for both parties. A main area of cooperation is the potential India partnership in the Joint European Torus (JET) programme. The two sides agreed to establish a bilateral 'Task Force on the JET ELM coils project'. The mapping of bilateral collaborative activities between European and Indian labs is ongoing.

Negotiations are also ongoing to allow India to join the Joint Programming Initiative on Water²⁹ which is one of the important areas of cooperation between the EU and India and would contribute to the India-EU Water Partnership mentioned above.

India is a region where there are significant prospects for Concentrated Solar Power (CSP). Deployment and research cooperation activities can target specific applications, for example small-size CSP installations for rural areas.

In the field of ICT, the areas of cloud computing, high performance computing, language technologies, Internet of Things and e-infrastructures were identified as potentially promising areas for cooperation in the last meeting of the Joint ICT Working Group of January 2015.

2.5.3. *Framework Conditions*

Framework conditions for cooperation in research and innovation between the EU and India are relatively satisfactory. However, the Indian patent regime should be strengthened; the complex legal framework simplified; and doing business made more transparent. R&I cooperation potential is also inhibited by procedural delays and capacity constraints in certain government departments.

To support the participation of entities established in India in Horizon 2020 collaborative projects, a co-funding mechanism has been agreed with the DBT³⁰. The mechanism covers all areas related to biotechnology: health, agriculture, food security, bioeconomy and bioenergy. A similar mechanism is being negotiated with the Department of Science and Technology and the Department of Electronics and Information Technology.

Discussion with Indian authorities will be pursued to improve framework conditions for innovation, to promote the opening of Indian R&I programmes to EU researchers and to simplify administrative procedures.

²⁸ <http://www.jpiamr.eu/>

²⁹ <http://www.waterjpi.eu/>

³⁰ <http://www.dbtindia.nic.in/wp-content/uploads/DBT-EUcallsunderH2020-.pdf>

2.6. Japan

2.6.1. Japan as a partner of the EU

The relations between the EU and Japan have developed steadily over the past two decades. Sharing many of the same challenges (energy security, access to critical raw materials, ageing populations) and defending a similar approach to key international challenges such as international security and climate change, Japan is in many ways one of Europe's closest partners on the international arena. The twin negotiations on a Free Trade Agreement (FTA) and on a wider Strategic Partnership Agreement (SPA) covering political dialogue, cooperation in addressing regional and global challenges, and sectoral cooperation, including Science and Technology (S&T), are at the centre of the EU-Japan agenda. Their conclusion in 2016 is an EU priority.

Japan is a global leader in S&T, accounting for 10% of global expenditures on R&D and 19 Japanese Nobel Prize winners in the natural sciences. Japanese R&D spending as a share of GDP amounts to 3.87% according to Japanese statistical data (OECD estimate: 3.59%³¹), close to the long-term goal of 4%. The 5th Basic S&T Plan (2016-2020) covers many areas that are also STI priorities on the EU side, and it is expected to result in new cooperation possibilities that generate tangible results out of the new EU-Japan Strategic Partnership in Research and Innovation (R&I).

EU-Japan cooperation in a number of strategic R&I areas is expected to increase the impact of research, promote innovation and strengthen the capacity to tackle global societal challenges.

2.6.2. Priorities for S&T cooperation

The 3rd EU-Japan Joint S&T Committee meeting in May 2015 agreed on the following priorities for future strategic cooperation: (1) maintaining areas where cooperation is already substantial, namely ICT, Aeronautics and Materials (including Critical Raw Materials - CRMs); and (2) strengthening cooperation in Energy (non-nuclear), Health, Environment and High-Energy Physics. Furthermore, cooperation is already substantial in Nuclear research, and there is a potential to increase cooperation in other areas such as Space, Security, and Research Infrastructures.

ICT: Three coordinated calls have been launched since 2014 with the Ministry of Internal Affairs and Communication (MIC) and the National Institute of Information and Communications Technology of Japan (NICT) in 5G, Internet of Things, Cloud and Big Data. Under Horizon 2020 Work Programme (WP) 2018-2020, a forth joint call is being considered in areas such as 5G, Cloud, Internet of Things and Big Data. A joint call on "ICT Robotics based solutions for active and healthy ageing at home or in care facilities" has been launched. Cooperation in Active and Healthy Ageing is likely to continue in the future. Another key area of joint ICT research is micro- and nano-electronics; in WP 2016-2017 there is a call for twinning between EU-funded projects and counterparts in Japan funded by Japan Science and Technology Agency (JST). Cyber Security is another area of common interest. ICT Dialogues have been established between the European Commission (EC) and MIC with annual meetings to discuss ICT policies and R&I cooperation.

Aeronautics (and other transport areas): There is an EC-METI (Ministry of Economy, Trade and Industry) Working Group on Aviation research. Two coordinated calls have been launched since 2014 with METI/NEDO (New Energy and Industrial Technology

³¹ <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>

Development Organisation) in the areas of high-speed aircrafts, anti-icing systems, passenger-friendly cabins, heat exchanger systems for engines, composite structure manufacturing and smarter flight control. Support actions have been launched twice. In the field of automated vehicles, there is a trilateral dialogue (EU, Japan, US).

Materials research (including CRMs): Japan is a key partner in the EU-US-Japan Trilateral Dialogue on CRMs. There is cooperation in the area of substitution of critical metals in the WP 2014-2015 of Horizon 2020 and there are two call topics in WP 2016-2017 on materials research covered by the co-funding scheme of JST (see below) on the substitution of CRMs and advanced materials for power electronics.

Nuclear research: There is considerable cooperation in both fission and fusion (such as through ITER) under agreements between Euratom and Japan. Cooperation exists in the field of radioactive waste management, and cooperation could be strengthened in radiation protection, severe accident management, nuclear decommissioning and decontamination, as well as Generation-IV (future reactor systems). Through the Broader Approach partnership and post-Broader Approach, Japan is a key international partner for the European fusion programme (EUROfusion). There are also long standing collaborations between the JRC and Japanese organisations in the areas of safety of nuclear fuel and fuel cycles, nuclear safeguards and security, and nuclear measurements.

Energy research (non-nuclear): Cooperation has been discussed in areas such as hydrogen fuel cells, energy storage, carbon capture and storage, electric vehicles, and critical materials for energy. Discussions are ongoing on establishing a platform for the exchange of information on energy research. The Joint Programme 'Wind-Energy' of the European Energy Research Alliance (EERA) is interested in cooperating with Japanese institutes, and a workshop on floating wind is planned for November 2016. Collaboration opportunities also exist in catalyst development for biomass conversion and emission reduction.

Health research: The EU and Japan cooperate in multilateral initiatives aimed at addressing global health challenges, such as the International Human Epigenome Consortium (IHEC), the Human Frontier Science Programme (HFSP) (where Japan is the most significant funder), the International Human Microbiome Consortium (IHMC), the International Cancer Genome Consortium (ICGC), the International Mouse Phenotyping Consortium (IMPC), the International Rare Diseases Research Consortium (IRDiRC) and the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R). A coordinated call with MIC/NICT on ICT Robotics for active and healthy ageing has been launched. There is scope for cooperation through the European and Developing Countries Clinical Trials Partnership (EDCTP) and through the Joint Programming Initiative on Anti-Microbial resistance (JPIAMR). The Japan Agency for Medical Research and Development (AMED), launched in 2015, represents an important interlocutor for the EU in this area.

Environment research: Cooperation exists through multilateral initiatives (Group on Earth Observations, Belmont Forum, Future Earth). High-level EU-Japan workshops on climate change are organised. "Nature-Based Solutions" for Disaster Risk Reduction (DRR) and sustainable urbanisation is a possible area for future cooperation. In the area of DRR, the JRC has a multi-annual collaboration agreement with the Disaster Prevention Research Institute of Kyoto University and collaboration with the Japanese Building Research Institute.

Research Infrastructures (RIs): Dialogues have been ongoing in high-energy physics, agriculture, biotechnology and genomics. Japanese facilities are among the ones listed in the European Roadmap for Research Infrastructures, in the domains of astrophysics (Cherenkov Telescope Array - CTA), environmental sciences (EISCAT 3D - Europe's

Next-Generation Radar for Atmospheric and Geospace Science) and arctic sciences (Svalbard Integrated Earth Observing System - SIOS). Japanese RIs are participating in European initiatives such as the European Circular Energy-Frontier Collider Study (EuroCirCol) funded through Horizon 2020, and are collaborating with European partners in the field of population ageing (SHARE). The Horizon 2020 projects E-JADE and JENNIFER under the Marie Skłodowska-Curie Action (MSCA)-Research and Innovation Staff Exchange (RISE) have Japanese participation.

Space research: The EU and Japan have an advanced space S&T sector and a powerful space industry, and there is an EU-Japan Space dialogue as well as long-standing cooperation in research projects. There are promising areas for cooperation in the Copernicus programme (Earth observation and climate change, e.g. CO2 monitoring, oceans monitoring, support for the management of natural disasters). Regarding the satellite navigation system, there could be a real potential for working together in the area of applications (autonomous driving, 3D mapping, rail, agriculture and Global Navigation Satellite System – GNSS - standardization) receivers and on new services such as the emergency warning service.

Security research: There is a strong potential for R&D exchanges on Crisis Management and on the equipment of first responders. There is also a Cyber Security dialogue with Japan, launched in 2014.

Cooperation with Japan is also progressing in the context of the EU FET Flagship on Human Brain (HBP), which aims at developing large-scale simulation of human brain and mouse brain data. The other FET Flagship on Graphene is also an area of cooperation. In both areas, regular workshops are taking place with the participation of prominent European and Japanese research organisations to further develop this cooperation.

In addition, Japan's National Institute of Advanced Industrial Science and Technology (AIST) and the JRC are currently discussing to formalise their cooperation in the fields of nanotechnology, metrology, standardisation and photovoltaic, via a Research Framework Arrangement.

Besides cooperation in thematic areas, both parties agree on the importance of regular consultations and collaboration on major STI policy issues, such as on Open Science. The G7 S&T Ministerial meeting in May 2016 agreed to establish a G7 working group on Open Science, which the EU and Japan will co-lead. Another cooperation area is outreach to society, highlighting the benefits of EU-Japan cooperation in STI. An example of this is the European participation in "Science Agora 2015", a major science communication event organised annually by JST in Tokyo.

2.6.3. Framework Conditions

Framework Conditions for R&I cooperation with Japan are good, as could be expected from one of the world's leading scientific 'powerhouses'. Japan offers a predictable legal framework and intellectual property rights protection. However, European companies may still encounter non-tariff barriers, and Japan has a relatively challenging market for foreign investment. The current FTA negotiations are focusing on the removal of non-tariff barriers and on the opening up of public procurement in Japan to EU businesses. A closer harmonisation of standards would be beneficial for both sides.

Efforts are being made to consolidate framework conditions that facilitate R&I cooperative activities. Promoting opportunities for increasing the mobility of researchers between Europe and Japan is important. The Implementing Arrangement between the

Commission and the Japan Society for the Promotion of Science (JSPS) provides opportunities for Japanese researchers to pursue research collaboration with European Research Council grantees in Europe³². The MSCA provide further opportunities for researchers' mobility.

The 23rd EU-Japan Summit in May 2015 acknowledged the importance of establishing streamlined mechanisms for the joint funding of R&I projects to fully exploit the potential of EU-Japan cooperation. The funding scheme developed by JST in close collaboration with the Commission is an important step forward. The scheme is being implemented for the first time in WP 2016-2017 of Horizon 2020.

³² JSPS and JST also fund long-term visits to Japan by overseas researchers. A number of bilateral schemes are in place.

2.7. Mexico

2.7.1. *Mexico as a partner of the EU*

In 1997, Mexico was the first Latin American country to conclude an Economic Partnership, Political Coordination and Cooperation Agreement with the European Union, in key areas of political, trade and security cooperation. Free Trade Agreements followed in 2000 for trade in goods and in 2001 for trade in services. The EU and Mexico also established a Strategic Partnership in 2008, implemented by a Joint Executive Plan endorsed in 2010. Both sides have decided to adapt the contents of the Global Agreement and the Strategic Partnership to reflect recent global geopolitical shifts and the negotiations on the new modernized agreement started in June 2016.

Mexico ranks 15th among the EU's trade partners (16th in exports and 21st in imports) whereas the EU remains Mexico's second largest export market.

The current Mexican government has made enormous progress in its structural reforms agenda in various sectors including the areas of telecommunications and energy, aimed at raising productivity, competitiveness and potential output growth. The reform of the energy sector has major implications for renewables with an ambitious goal to generate 35% of its energy from renewable sources by 2024.

The capacity of Mexico as a strategic research and innovation partner of the EU is therefore increasing, and the potential of our cooperation to promote breakthroughs, tackle global societal challenges and increase our competitiveness on world markets is growing.

The Bilateral Agreement for scientific and technological cooperation between the European Community and the United Mexican States was signed on 03/02/2004 and came into force on 13/06/2005.

2.7.2. *Priorities for S&T cooperation*

The Joint Steering Committee (JSC) which oversees the implementation of the EU-Mexico S&T Agreement has emphasised the need to deepen, scale up and open cooperation in selected thematic areas. This has led to a number of initiatives:

In the energy area, a coordinated call on 'Enhanced Geothermal Systems and superhot systems' was launched in the 2016-17 WP of Horizon 2020 under the 'Secure, Clean and Efficient Energy' challenge. 10 Million Euros have been earmarked for the call on each side. A second call on geothermal energy may be envisaged. Furthermore, both parties agreed to explore other areas of possible cooperation including smart grids, solar energy and energy storage, bearing in mind that prospective benefits need to be mutual and shared by the respective stakeholders.

In the ICT area, promising collaboration is taking shape in the context of the Future Internet Public Private Partnership. One of the objectives is to establish links between Mexico and the EU on Future Internet services by setting up FIWARE Lab installations (Future Internet ware) in Mexico and supporting the development of services based on those platforms. The 2016-2017 Leadership in Enabling and Industrial Technologies ICT WP of Horizon 2020 targets inter alia the development, implementation and replication of FIWARE-based services in the EU and Mexico. Both parties also envisage future cooperation on High Performance Computing applications such as High-Performance Computing for energy (including various sub-fields like oil, renewables, wind, etc.), life sciences, earth sciences, air pollution and natural disasters. In WP2018-2020, the aim is

to build upon the established relations and co-operations by focusing on Next Generation Internet research themes. At the occasion of the OECD meeting in Cancun (22-24 June 2016) it was agreed to start an ICT Policy dialogue by the end of 2016.

In the area of health, cooperation will continue in the context of the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) and the Global Alliance for Chronic Diseases (GACD). Efforts will be made to strengthen the participation and contribution of Mexican organisations in the Horizon 2020 health research programme. The Commission extended an invitation to Mexico to join the International Rare Disease Research Consortium (IRDiRC) in order to maximize the output of rare diseases research at a global level.

In the area of environment and climate change, the Mexican National Council of Science and Technology (CONACYT) confirmed its interest to explore becoming a full member of the Belmont Forum. Both parties are also exploring possibilities for developing a strategic cooperation in Marine research and welcomed the possibility that Mexico could join the Atlantic Ocean Research Alliance.

The JRC and CONACYT have launched discussions in view of exploring possibilities for developing a more strategic and structured approach to their cooperation, including biodiversity, metrology and food safety, using smart specialisation; linking with the EU Reference laboratories (EURLs) coordinated by the JRC³³.

In the area of Intelligent Manufacturing Systems, it was agreed to work together through the global IMS initiative³⁴ with a special focus on production technologies and processes, ICT for manufacturing and the nano-manufacturing. Mexico will support Mexican participants in IMS through CONACYT funds. Mexico currently holds the chair of IMS and the World Manufacturing Forum will be held in Mexico at the end of 2017.

In the area of social sciences and humanities, Mexico continues its strong involvement in the Trans-Atlantic Platform dealing with social sciences and humanities. This EU funded initiative is a collaboration between key humanities and social science funders from South America, North America and Europe. The Platform facilitates the formation of networks within the social sciences and humanities and helps to heighten awareness of the crucial role the social sciences and humanities play in addressing 21st century challenges.

In liaison with the Enterprise Europe Network, Mexico has set up the Enterprise Mexico Network to connect Mexican small businesses and researchers to qualified global opportunities, facilitate international partnerships and create trade through access to public and private sector resources. As part of the cooperation, the Enterprise Europe Network provides information on events and access to a database of European and international companies in different economic sectors.

As an example of leveraging other cooperation funding mechanisms, the Partnership Instrument (of the European External Action Service), is funding the Low Carbon Business Action which was launched in August 2015 and will last for 2 years (1.5MEUR). This will facilitate partnerships between EU and Mexican SMEs in the

³³ Between 2013 and 2015, Smart Specialisation strategies were developed in all 32 States (including Mexico City) and three regions (north, centre-north and South-southeast), based on the European RIS3 methodology and were called *Agendas de Innovación*. The innovation strategy and associated action plan for each State were defined with the aim of becoming the cornerstone for the territory's development and potential to innovate and compete in the regional, national and global context.

³⁴ IMS is an industry-led, international business innovation and research and development program established to develop the next generation of manufacturing and processing technologies through multi-lateral collaboration: <http://www.ims.org>.

fields of energy efficiency and waste management. Five matchmaking events will be organised in Mexico in the framework of the project.

2.7.3. *Framework Conditions*

To support the participation of entities established in Mexico in Horizon 2020 projects, CONACYT has established the so-called Conacyt-H2020 co-funding mechanism³⁵, in place since 2014. This co-funding mechanism provides a source of financing for "project-by-project participation" by Mexican partners in Horizon 2020 projects covering all thematic areas. This complementary funding mechanism aims to reinforce EU-Mexico STI cooperation by increasing the participation of Mexican research institutions and companies in Horizon 2020.

The EU-Mexico Joint Steering Committee has also agreed to continue to support efforts of multipliers, notably National Contact Points, for facilitating access to information and partnering of R&I stakeholders. Moreover, both sides agreed to jointly promote the organisation of R&I Days and other matchmaking events to facilitate partnering with both academia and industry with the support of the EU funded EU-MEX-Innova Bilat project.

The importance of schemes for researchers' mobility has also been highlighted. The signature of the new implementing Arrangement between the European Research Council (ERC) and CONACYT in November 2015 represents an important stepping stone in the S&T relations with Mexico. Further joint efforts to promote the participation of Mexican researchers and research institutes in the EU's Marie Skłodowska-Curie Research Fellowship Programme will also be made.

³⁵ <http://www.conacyt.mx/index.php/el-conacyt/convocatorias-y-resultados-conacyt/convocatoria-conacyt-horizon2020>

2.8. New Zealand

2.8.1. *New Zealand as a partner of the EU*

As 'like-minded' partners, the EU and New Zealand share many common values and interests and see eye-to-eye on key international and global issues in many major international fora, among them the United Nations, the Pacific Islands forum and the OECD, including on climate change, openness of world trade, security and development in the Asia and Pacific regions, and promotion of human rights.

EU and New Zealand have commenced work towards the launch of negotiations for a Free Trade Agreement in order to remove existing market access barriers for goods, services, investment and public procurement.

New Zealand and the EU have a productive science and innovation relationship extending back over many years with science and innovation systems that are strongly aligned. The Partnership Agreement for Relations and Cooperation to be signed by the two parties in 2016 clearly identifies science and innovation as a key area for developing relations. Indeed, New Zealand has world-class expertise in areas such as big data, energy, resilient structures, precision agriculture and related technology.

2.8.2. *Priorities for S&T cooperation*

At the Joint Science and Technology Cooperation Committee (JSTCC) meeting of December 2014 the two sides emphasized the need to deepen, scale and open up cooperation in many areas:

In bio-economy, the potential transformation of the Knowledge-Based Bio-economy Forum (involving Australia, Canada, EU and New Zealand) into a wider International Bio-economy Forum was discussed. This new forum under construction would be built on a programme-level spirit, through joint projects, twinning activities, scientific workshops, and by linking with EU Member States. In parallel, there are also opportunities for connections and collaborations between the New Zealand National Science Challenges (Our Land & Water, The Deep South & Science for Technological Innovation) as well as the New Zealand Agricultural Greenhouse Gas Research Centre and the European Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI), with which New Zealand already has some links. In the future New Zealand could take advantage of the existing links via more formal sharing and promotion of JPI activities to organisations from New Zealand, e.g. knowledge hubs, ERA-NETs or applying to Horizon 2020 calls.

Further to the International Panel on Climate Change (IPCC) findings on the need for a 'whole ocean' strategy, ocean research strategy and governance could be developed in concert with New Zealand. The EU blue growth initiative and the NZ specific national science challenge on sustainable seas³⁶ offer a strong basis to collaborate on strengthening the blue economy as the two partners are well equipped with strong research capacities in marine and maritime research.

Regarding health research, New Zealand and the EU cooperate in multilateral initiatives aimed at addressing global health challenges. New Zealand is, with the EU, one of the countries contributing to the Human Frontier Science Programme (HFSP). The Commission encourages New Zealand to join the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R).

³⁶ <http://sustainableseaschallenge.co.nz/>

The Commission and New Zealand are discussing possibilities to collaborate into two key areas: administrative big data and precision agriculture.

In the domain of research infrastructures, a certain degree of cooperation has been already established in the fields of bio-molecular and agricultural technologies, biodiversity and e-infrastructures (networking, grids, computing). New fields should be explored in the near future, such as ocean monitoring, disaster mitigation, climate modelling and aqua cultures. Potential new opportunities for cooperation emerge from the publication of the 2016 ESFRI Research Infrastructures roadmap³⁷.

In the context of COP21, New Zealand decided to become a member of the global geothermal alliance³⁸ and geothermal energy³⁹ could be a very promising field for future collaborative actions.

2.8.3. *Framework Conditions*

There are no significant barriers to cooperation with New Zealand, which has also been recognised in the last ten years as offering one of the most stable business-friendly environments in the world according to the World Bank (New Zealand ranks 1st in 2005 and 2nd in 2015 in the 'Doing Business' index).

New Zealand places high priority on international science connections and Europe is seen as a key partner. Collaboration with international science partners is supported across New Zealand's domestic science funding programmes. The recently reframed Catalyst Fund is a tactical fund which specifically supports activities that initiate, develop and foster international science collaboration. The action-oriented approach taken by the New Zealand funders and research communities towards financially supporting New Zealand researchers' participation in Horizon 2020⁴⁰ is facilitating collaboration. Framework conditions for building innovation linkages, including cooperation between SMEs, are also attractive as New Zealand has developed an advanced innovation ecosystem. New Zealand is also a full member of the Enterprise Europe business Network (EEN)⁴¹.

³⁷ <http://www.esfri.eu/roadmap-2016>

³⁸

http://www.irena.org/News/Description.aspx?NTtype=A&mnu=cat&PriMenuID=16&CatID=84&News_ID=438

³⁹ <http://iea-gia.org/about-us/members/>

⁴⁰ https://ec.europa.eu/research/iscp/pdf/policy/eu_nz_communique.pdf

⁴¹ <http://een.ec.europa.eu/>

2.9. Republic of Korea

2.9.1. *The Republic of Korea as a partner of the EU*

Since 2010, the EU and the Republic of Korea (South Korea) have upgraded their relationship to a Strategic Partnership with agreements in key areas of political, trade and security cooperation, including on global challenges such as terrorism, energy security, and climate change. South Korea is the EU's 8th largest export destination, whereas the EU is South Korea's 4th export destination. EU investment in South Korea is the largest source of Foreign Direct Investment.

Over the past few decades, South Korea has achieved tremendous economic growth and global integration to become a high-tech industrialised economy. South Korean R&D spending as a share of GDP has exceeded 4.1%, which has placed the country at the frontier of cutting-edge technologies, advanced systems and solutions in a range of sectors, from ICT, materials, chemistry and nanotechnologies to health and energy.

EU-South Korea cooperation in a range of strategic R&I areas is therefore increasing the impact of research, promoting breakthroughs and boosting the ability of both sides to tackle global societal challenges effectively and to compete on world markets.

2.9.2. *Priorities for S&T cooperation*

Both the EU and South Korea emphasise the need to deepen, scale up and open opportunities for cooperation in selected thematic areas.

In the ICT area, a joint call was launched under the 2016-17 WP of Horizon 2020 addressing the topics of 5G communication networks, Internet of Things and brokerage of mobile cloud services. A second joint call is foreseen under Horizon 2020 WP 2018-20 addressing these areas with ongoing discussion with Korean counterparts at MSIP/IITP. The bilateral ICT cooperation also includes other ICT and 5G policy areas such as standardisation and spectrum management.

In the non-nuclear energy area, both sides are engaging in twinning activities in the area of technologies and processes for post- and/or pre-combustion carbon capture. Initiatives for collaboration between EU projects, selected under the 2016-17 WP of Horizon 2020, and endorsed South Korean projects are launched from 2016 onwards.

In the area of nanotechnology, during 2015 and 2016 both sides cooperate through Nanoreg, the multilateral nanosafety initiative for regulatory testing of nanomaterials.

In the area of health and bio-medical challenges, cooperation continues in the context of the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R). The EU and South Korea are also both participating in the International Rare Diseases Research Consortium (IRDiRC) and the International Human Epigenome Consortium (IHEC).

In the area of satellite navigation, the EC-Korea Satellite Navigation Cooperation Agreement, which entered into force on 1 July 2016, foresees the promotion of joint research activities.

Potential further areas of future EU-South Korea S&T cooperation include micro/nanoelectronics, where the two sides have agreed to exchange roadmaps and pursue with twinning/joint activities in view of exploiting synergies and developing a more intense cooperation. Another potential area is materials modelling, where both sides have agreed to promote cooperation and South Korea's active cooperation with the European Materials Modelling Council, a network of materials modelling stakeholders.

In the area of satellite navigation both sides have agreed to continue promoting joint research activities and partnering. Further possibilities are in the areas of innovative medicine and medical equipment, where cooperation could be strengthened e.g. on Anti-Microbial Resistance, via the existing Joint Programming Initiative, and the International Initiative for Traumatic Brain Injury Research. New cooperation opportunities are also being sought in Smart Grids and other emerging areas in the energy industry sector, e.g. through the 'Mission Innovation' initiative on clean energy innovation.

In nuclear energy research, a bilateral Work Program has been adopted with consolidation and extension of collaborative activities, specific cooperation between the South Korean KSTAR and the European JET programmes, joint exploitation of fusion facilities for risk mitigation in ITER delays, discussion on principles of an international networking of facilities in support to ITER, and potential South Korean participation in specific Broader Approach activities.

In fission, cooperation could continue under the calls of the Euratom Programme, and future nuclear energy systems will continue to be addressed (including within the Framework Agreement for International Collaboration on R&D of Generation IV Nuclear Energy Systems). In fusion, South Korea and Euratom have roadmaps for Demonstration Power Station developments. South Korea might be involved in the European fusion programme and the EUROfusion programme including through consolidation of cooperation between the JET and KSTAR tokamaks.

The European Commission's Joint Research Centre collaborates with South Korean institutions on seismic testing techniques for infrastructures, R&D and standardisation in construction.

2.9.3. Framework Conditions

The EU-South Korea Free Trade Agreement is creating new opportunities for market access. It includes provisions in areas such as competition policy, government procurement, intellectual property rights, transparency in regulation and sustainable development.

In spite of the government-level agreement setting positive framework conditions, some practical issues in R&I cooperation still remain to be improved. These are illustrated by the low real access for South Korean-based European entities to South Korean R&I programmes, and the lack of penetration in public procurement of R&D services and innovative solutions. Today, only very few European companies undertake R&D activities in South Korea, whereas there are growing opportunities for cooperation, both in research and in innovation.

To support the participation of entities established in South Korea in Horizon 2020 projects, the South Korean government regularly launches calls for application to co-fund such participation. The mechanism covers all thematic areas of Horizon 2020. The two sides have agreed on early exchange of programme information to enable provision of such co-funding and to allow for monitoring of the cooperation intensity, as well as to continue to support efforts of multipliers, notably National Contact Points and matchmaking events to facilitate partnering with both academia and industry.

Schemes for researchers' mobility are important cooperation arrangements. The Implementing Arrangement for South Korean researchers to join the teams of European Research Council Principal Investigators, signed during the EU-South Korea summit in 2013, is progressing well with several calls and successful visits already undertaken.

Mobility of researchers is also promoted through the EU's Marie Skłodowska-Curie Research Fellowship Programme with hundreds of exchanges already taking place.

2.10. Russian Federation

2.10.1. *The Russian Federation as a partner of the EU*

Russia is the scientifically most important non-associated neighbour country to the EU. With a total R&D spending of about 35 billion euros (2011), Russia would rank between EU Member States like Italy and the UK. A high share of Russian R&D is performed by the business sector (62.4 %), while the government provides the major share of funding (66.5%) (figures of 2009⁴²).

Scientific relations with Russia are based on a long tradition of excellence, a large network between scientists and scientific institutions, and they are underlined by important and well known achievements in diverse areas of science and their applications. Supporting these relations remains a priority, as was confirmed during the EU-Russia Joint Science & Technology Cooperation Committee meeting, which took place on 24 June 2016 in Moscow. Restrictive measures imposed on Russia following the illegal annexation of Crimea and the destabilisation of Eastern Ukraine do not target S&T collaboration, except for certain technological fields related to off-shore oil and gas exploration, and military applications.

2.10.2. *Priorities for S&T cooperation*

All scientific fields of joint interest are a priority for EU-Russian S&T cooperation. This broad approach is based on the recognition of the neighbourhood, good EU-Russia S&T relations and the importance of Russian science. It is also in accordance with the recommendations from the Working Group on Russia of the Strategic Forum for International Cooperation (SFIC). In-depth discussions within the working group have led to the result that focusing collaboration exclusively on a specific list of subjects would lead to omit other equally important subjects where collaboration with Russia exists already at a level that would not justify leaving them out.

The Russian Ministry of Education and Science regularly updates a list of subjects from the Horizon 2020 WP which are of interest for the Russian side. The list is published within the Russian Country Page, which also describes the Russian co-funding mechanism, on the Horizon 2020 Participant Portal.

Collaboration in research infrastructures is a priority, including arctic research, Russia's membership in the Group of Senior Officials (GSO) and Russia's offer for access to its future six Megascience facilities – facilitated by CREMLIN project – Connecting Russian and European Measures for Large-scale Research Infrastructures, and through a wide range of Russian infrastructures (currently 54 infrastructures) that are open for European collaboration.

Innovation cooperation will be enhanced mainly via EUREKA and EUROSTARS.

In addition, several Working Groups and dialogues have focused on research cooperation in the areas of aeronautics, nuclear safety, space, material science and arctic research. Priority shall be given to Russia joining global initiatives in research related to health (e.g. the Global Research Collaboration for Infectious Disease Preparedness) and the bioeconomy. New initiatives are also possible and timely in the area of transport related to Clean Sky II, to European – Asian rail or to the northern passage from Europe to Asia through Arctic waters.

⁴² National Science Board, Science and Engineering Indicators 2012, p. 4-47.

In nuclear fission research both sides possess complementary nuclear expertise and infrastructures. Areas to be further exploited in bilateral cooperation are nuclear safety, plant-life management and life extension of existing nuclear power plants as well as specific aspects of the new Generation-IV reactors and systems (in particular fast neutron reactors). In fusion research, Russia has the capability of contributing to JET in the field of diagnostic development and application, plasma/first wall interaction studies, gyrotrons, as well as in other physics domains.

2.10.3. Framework Conditions

Recent Russian regulations have improved conditions for foreign researchers working in Russia, even though some problems still persist as regards, for example, to registration of foreign offices in Russia or granting visa for foreign researchers visiting private institutes for more than three months per year. On the European side, the Scientific Visa Package facilitates the procedure of admitting researchers who are third-country nationals to Europe for the purpose of scientific research (EU Directive 2005/71/EC). The latter is especially important for allowing Russian scientists access to those research facilities where they have invested bigger shares or which are operated jointly.

The Russian Ministry of Education and Science established a co-funding mechanism for Russian participants in Horizon 2020 actions and for Russian collaboration with EU Member States. The priorities for Russian co-funding are frequently updated and published as the Russian Country Page on the Horizon 2020 Participant Portal. The policy dialogue focusses on further developing the co-funding mechanism and participation in ERANETs.

The Marie Skłodowska-Curie actions (MSCA) part of Horizon 2020 (2014-20) continue to offer diverse opportunities for EU-Russia scientific cooperation. Two Russian programmes supporting mobility are the mega grants attracting top-level researchers to Russian institutions and the scholarships of the President of Russia supporting Russian PhD students abroad.

2.11. United States

2.11.1. *The United States as a partner of the EU*

The United States of America (US) is a long standing partner of the European Union, relations having been formalised in 1990 with the adoption of the Transatlantic Declaration. The European Union and the United States have the largest bilateral trade relationship and enjoy the most integrated economic relationship in the world. Research and innovation cooperation between the EU and the US is governed by the Agreement for Scientific and Technological Cooperation, which entered into force in 1998 and, after several renewals, is valid until October 2018.

Among individual countries, the US remains by far the biggest R&D performer in the world, accounting for almost 30% of global R&D expenditures. 39% of its GDP comes from high-technology manufacturing and knowledge-intensive service industries. It has a research intensity of 2.7%.⁴³ Regarding participation to Horizon 2020, the US is so far the leading third country participant, both in number of participations and in funding.

The federal government is the primary funder of basic research with technological development primarily funded by industry. While US federal investment in R&D has somewhat stagnated since 2010, US business has increased its R&D investments, particularly in growing, high-opportunity sectors. Throughout a large country like the US certain States like California or Massachusetts play a dominant role in the overall global scientific impact of the country. Interestingly, while the USA is the current world leader in R&D, other countries are catching up and the gap to the followers is closing.

The U.S has established a global network of scientific cooperation and is also a privileged partner country for many EU Member States in science, technology or innovation cooperation.

2.11.2. *Priorities for S&T cooperation*

Under the EU-US Science and Technology Agreement, health research cooperation with the US National Institutes of Health (NIH) is a key priority, benefiting from mutual opening of the respective programmes leading to significant levels of cooperation in the first years of Horizon 2020. NIH participates also in several multilateral initiatives together with the EU, such as the International Rare Diseases Research Consortium (IRDiRC), International Cancer Genome Consortium (ICGC) and the Global Alliance of Chronic Diseases (GACD).

In the area of transport research there is a clear interest in collaborating in areas where inter-operability is necessary to ensure smooth and secure transatlantic/global flows (e.g. transport management systems and cargo tracking and tracing, aviation in general).

EU-US cooperation on energy technology research and innovation continues to be promoted under the EU-US Energy Council and its Technology Working Group. Horizon 2020 has put a strong emphasis on clean energy research and innovation compared to previous Research Framework Programmes. Indeed, there is strong potential for EU-US cooperation as follow up to COP21 and under the Mission Innovation initiative with both sides aiming to strengthen and accelerate global clean energy innovation with the objective to make clean energy widely affordable. Related research, development and

⁴³ National Science Board Science and Engineering Indicators 2016:
<http://www.nsf.gov/statistics/2016/nsb20161/#/report>

demonstration issues are expected to become a major driver to focus the cooperation between the EU and US in the years to come.

Fusion energy is one of the four priority areas agreed to expand under the EU-US Energy Council. The bilateral cooperation in the field of nuclear fission energy research cooperation will continue to focus on nuclear safety as the highest priority.

A specific call in 2017 will provide European and North American researchers, industry and policymakers with a platform to enhance and deepen transatlantic dialogue on environmental issues related to Carbon Capture and Storage (CCS) and to accelerate learning and provide advanced training on unconventional hydrocarbon development. Connecting pilots and projects across the Atlantic should bring the benefits of cross-validation of technologies, sharing results, distributing tasks, bundling expertise and expanding professional networks.

The area of marine and Arctic cooperation should further expand as the implementation of the Galway Statement increases momentum. The type of activities could be more programme level cooperation in form of programme alignment with relevant US partners as discussed with NSF, NASA and in particular NOAA.

The EU Human Brain Project⁴⁴ and the US BRAIN Initiative⁴⁵ provide a further possibility for large scale cooperation on the basis of existing initiatives. In the case of the FET Flagship Graphene, a EU-US collaboration scheme has been launched together with NSF.

Over the last years regular workshops on Future Internet Experimentation have been organised between EU and US. In the annual EU-US ICT Dialogue 2016 it was agreed to explore possibilities to scale up the collaboration.

Another ICT area where a further development of EU-US cooperation is expected is cyber-physical systems (CPS). This transatlantic collaboration on societal-scale CPS should promote global standards and interoperability for safe and secure CPS platforms and applications.

Collaboration between Europe and the United States in the domain of Research Infrastructures is considered as highly strategic especially in the frame of consolidating the support to the Transatlantic Ocean Research Alliance. Increased cooperation on marine and Arctic Research Infrastructures (interoperability, data management, better use and access, funding strategy, innovation and links with industry) is planned. The publication of the 2016 ESFRI Research Infrastructure roadmap also provides a number of additional opportunities for collaboration which could be explored in the frame of dedicated dialogues.

In addition, direct scientific cooperation between the JRC and the US is progressing with NOAA, the U.S. Geological Survey (USGS), and the U.S. Department of Energy (DOE).

2.11.3. Framework Conditions

The US provides innovation-friendly framework conditions and its investment climate makes it an attractive place to commercialize innovative products, services and solutions. In addition, the US has one of the world's strongest legal systems for the protection of intellectual property rights.

⁴⁴ <https://www.humanbrainproject.eu/>

⁴⁵ <http://www.nih.gov/science/brain/>

The general framework conditions for EU-US cooperation have been improving over successive Framework Programmes. As a unique feature in the bilateral S&T cooperation, US participants are eligible to receive EU funding in projects funded through the Horizon 2020 Health challenge, reflecting the reciprocal funding offered to EU participants by the NIH.

While cooperation tends to become more visible and effective at programme level, bottom up project participation is also a strong feature of the cooperation. Some US Federal entities are reluctant or unable to sign the Horizon 2020 grant agreements and therefore do not become formal partners in Horizon 2020 projects. The two sides have agreed that progress on reciprocal understanding of legal, administrative and financial issues of Horizon 2020 as well as relevant US programmes is needed.

3. DEVELOPING COUNTRIES / REGIONS

3.1. South Africa

3.1.1. *The Republic of South Africa as a partner of the EU*

The Trade, Development and Cooperation Agreement (TDCA) of 2000 is the legal basis for the overall relations between the Republic of South Africa (South Africa) and the EU. The TDCA covers political dialogue, the establishment of a free trade area over an asymmetrical twelve-year period, development cooperation, economic cooperation, and cooperation in a whole series of other areas. Scientific collaboration between South Africa and the EU is monitored by the Science and Technology Cooperation Agreement which was concluded in 1996 and entered into force in November 1997. The cooperation allows to jointly tackle global challenges building on complementary knowledge, geographical conditions and optimising the use of world-class research infrastructures. Moreover, the EU and South Africa agree that one of the requirements for an effective fight against poverty in the African Caribbean Pacific countries is the application of knowledge gained from science and technology to promote innovation and develop appropriate technologies to be deployed locally. Positive achievements also result from effective synergies between EU Research and Development policies and instruments in addressing South Africa's needs in terms of strengthening local scientific and technological capacities and contributing to the emergence of an innovation-friendly environment.

3.1.2. *Priorities for S&T cooperation*

As member of the European and Developing Countries Clinical Trials Partnership⁴⁶ (EDCTP2), South Africa will continue to cooperate with the EU and EDCTP2 members on infectious and parasitic diseases such as AIDS, tuberculosis, malaria, sleeping sickness, hookworm diseases and Ebola. South Africa and the EU will continue to cooperate in multilateral health research initiatives which aim to address global health challenges, such as the Global Alliance for Chronic Diseases and the Global Research Collaboration for Infectious Disease Preparedness, in which both South Africa and the European Commission participate as members. Cooperation also takes place in the Global Tuberculosis Vaccine Partnership, co-chaired by the Medical Research Council and the Department of Science and Technology of South Africa.

The EU and South Africa have a good level of cooperation in research infrastructures, e.g. in radio-astronomy and astro-particle physics. South Africa is one of the major players in the Square Kilometre Array (SKA) ESFRI roadmap projects, and has already designed and built the MeerKAT telescope as a pathfinder to the SKA. In the next years, the EU will continue supporting the development of the Square Kilometre Array through a dedicated grant signed at the end of 2015. South Africa is also an active member of the Group of Senior Officials on Global Research Infrastructures for which it has offered to take the chairmanship as of October 2016. South Africa will co-host with the European Commission, the International Conference on Research Infrastructures in Cape Town from 3 to 5 October 2016.

South Africa has set out a clear Earth Observation Strategy. Together with the European Commission (DG RTD), it co-chairs the Group on Earth Observations (GEO⁴⁷). The focus will be on supporting the implementation of the new 10 year strategic plan of the

⁴⁶ <http://www.edctp.org/>

⁴⁷ http://www.earthobservations.org/about_geo.shtml

Global Earth Observation System of Systems (GEOSS) and AfriGEOSS, the African segment of GEOSS. The EC and South Africa are also involved in the development of an Integrated Atlantic Observing System. Launched at the Rio+20 Summit in 2012, 'Future Earth' is a 10-year international research initiative that will develop the knowledge for responding effectively to the risks and opportunities of global environmental change and for supporting transformation towards global sustainability in the coming decades. Although a regional hub in Africa is being established, South Africa is still under-represented in this initiative. The South African National Research Foundation is the only African research & innovation funding agency that is a member of the Belmont Forum. The EU-South Africa Partnership could gain from more South African research and innovation funding agencies becoming members of the Forum.

South Africa has committed to the EU-Africa Research and Innovation Partnership on food and nutrition security and sustainable agriculture. A roadmap⁴⁸ towards this Research and Innovation Partnership, comprising a research agenda, short- to medium-term actions towards implementation (2014-2017) and reflections on long-term options for implementation (by 2020 and beyond) was adopted at the 3rd meeting of the EU-Africa High Level Policy Dialogue on 4-5 April 2016, in Addis-Ababa, Ethiopia. To-date, the Commission has committed 47.5 MEUR over 4 years (2014 and 2017) to this Research and Innovation Partnership, 30 MEUR from Horizon 2020 and 17.5 MEUR from the Pan-African Instrument and welcomes similar commitments from European and African countries.

Atlantic Ocean research cooperation is one of the main developing areas of joint interest. In parallel with the ongoing North Atlantic cooperation, significant steps have been taken towards an All Atlantic Ocean Research Alliance. South Africa signaled its interest to sign a Memorandum of Understanding with the Commission, similar to the one already signed with Brazil in November 2015. This document is scheduled to be signed in South Africa on the occasion of the next EU-South Africa JSTCC meeting in October 2016. In parallel, South Africa and Brazil signed a joint document on South-South Atlantic research cooperation in October 2015⁴⁹ aiming at developing a South Atlantic Science Plan. It also involves other South Atlantic countries, such as Namibia, Angola, Argentina and Uruguay. In this context, a broadening towards the Antarctic should be explored in the short term.

South Africa is actively involved in the ERANET COFUND Waterworks2015 which aims at pooling resources to implement a joint call for proposals in the area of sustainable water use in agriculture and forestry.

South Africa is a partner in the ERANET ERAMIN on mining and minerals research and innovation. Building on South Africa's involvement in this project, enhanced cooperation will be sought in the context of the European Innovation Partnership on raw materials.

3.1.3. *Framework Conditions*

Several activities have been undertaken in support of the participation of entities established in South Africa to Horizon 2020, namely training activities and information days about participation in Horizon 2020 were provided both to South African national contact points (NCPs) and to researchers and academics in South Africa. South Africa has set up a well-functioning network of National Contact Points.

⁴⁸ http://ec.europa.eu/research/iscp/pdf/policy/eu-africa_roadmap_2016.pdf

⁴⁹ https://ec.europa.eu/research/bioeconomy/pdf/declaration_of_intent.pdf

An Implementing Arrangement was signed in 2015 between the European Research Council and the National Research Foundation providing research opportunities in Europe for South African early-mid career researchers. South Africa became a member of EUREKA in 2014 and established a Europe Enterprise Network node in 2015.

A remaining problem lies in the commercialisation of research results⁵⁰. The EU shares its lessons-learnt with South Africa in this domain. South Africa has been a WTO member since 1995 and is a signatory to the TRIPS Agreement⁵¹ that resulted in expanded commitments to internationally binding guarantees of intellectual property rights.

⁵⁰ OECD Review Report on South Africa (2006)

⁵¹ http://www.wipo.int/wipolex/en/other_treaties/parties.jsp?treaty_id=231&group_id=22

3.2. African Union

3.2.1. *The African Union⁵² as a partner of the EU*

Africa is a unique partner for the EU for historical and geographical reasons. The high degree of interdependence between Africa and Europe as well as the shared principles of equal partnership and joint ownership have contributed to the development of a long-term, broad and evolving partnership across various policy areas.

Since the adoption in 2007 of the Joint Africa-EU Strategy (JAES) and the launch, at the 2010 Africa-EU Summit, of the High Level Policy Dialogue on science, technology and innovation, cooperation between the African Union and the EU has grown. At the 2014 EU-Africa Summit, the EU and African Heads of States and Governments agreed on the crucial role of science and innovation in boosting employment, competitiveness and growth, and in addressing pressing societal challenges such as food security, infectious diseases, energy efficiency and climate change. Africa needs to strengthen its capacity for innovation to participate more effectively in the global economy.

Positive achievements of EU-Africa cooperation are also the result of effective synergies between EU Research and Development policies and instruments in addressing the region's local scientific and technological capacities needs.

3.2.2. *Priorities for S&T cooperation*

During the last two years, important efforts have been deployed to pave the way towards an EU-Africa Research and Innovation Partnership on food and nutrition security and sustainable agriculture. The Research and Innovation Partnership aims at using a food systems' approach with a focus on sustainable intensification, nutrition, trade and markets, linking research to innovation, and involving all stakeholders, from research organisations to private sector (including farmers), civil society, and local and national authorities. A roadmap⁵³ towards this Research and Innovation Partnership, comprising a research agenda, short to medium-term actions towards implementation (2014-2017) and reflections on long-term options for implementation (by 2020 and beyond) has been adopted at the 3rd meeting of the EU-Africa High Level Policy Dialogue on 4-5 April 2016, in Addis-Ababa, Ethiopia. To date, the European Commission has committed 47.5 MEUR between 2014 and 2017 into this Research and Innovation Partnership, 30 MEUR from Horizon 2020 and 17.5 MEUR from the Pan-African Instrument and welcomes similar commitments from European and African countries.

At this 2016 EU-Africa High Level Policy Dialogue meeting, general discussion on potential future activities also took place with a focus on "global change" (climate change and renewable energy) and "global health". The EU-Africa High Level Policy Dialogue Bureau was tasked to come forward with a proposal by 2017.

'Global change' such as climate change and renewable energy demand a cross-cutting focus on earth observation tools and research infrastructures, i.e. the use of climate information and other data to support decision-making at various levels for administration, business and citizens' needs. With the Copernicus Climate Change Service and with the related European earth observation and climate service capabilities, the EU is already supporting climate services' developments in Africa through various actions of the European and of Member States development cooperation. These can be strengthened and further helped to reach operational capabilities through future scientific

⁵² <http://www.au.int/en/countryprofiles>

⁵³ http://ec.europa.eu/research/iscp/pdf/policy/eu-africa_roadmap_2016.pdf

cooperation activities, jointly supported by Horizon 2020 and the development cooperation programmes, also contributing to the Global Framework for Climate Services. The aspect of renewable energy will build on a recent study⁵⁴ on renewable energy and research and innovation capacity in Sub-Saharan Africa.

Closer cooperation is also sought in the context of the Belmont Forum. The Belmont Forum, created in 2009, is a global partnership of 21 research funding organisations and science councils investing in the advancement of interdisciplinary and transdisciplinary research in the field of global environmental change challenge.

In terms of global health, the second phase of the European and Developing Countries Clinical Trials Partnership⁵⁵ (EDCTP2) is working with a budget of nearly € 2 billion (2014-2024), of which € 683 million come from Horizon 2020. Today, 14 African countries and 14 Member States of the EU are part of EDCTP2 in which members work together against infectious and parasitic diseases such as AIDS, tuberculosis, malaria, sleeping sickness, hookworm diseases and Ebola. Closer cooperation with African countries is sought in Global Health research initiatives such as on non-communicable diseases (Global Alliance for Chronic Diseases), growing at a fast pace in Africa; Anti-Microbial Resistance (AMR) and emerging infectious diseases (Global Research Collaboration for Infectious Disease Preparedness).

Cooperation with Africa through the Group on Earth Observation (GEO) and its 10 year strategic plan to 2025 will continue. AfriGEOSS as the African segment of the Global Earth Observation System of Systems (GEOSS), should enhance earth observation and climate monitoring capacities in Africa, as part of the global system to deliver services in priority domains for Africa, such as for food security and health. In this context, the GEO governments, when they agreed to adopt the GEOS strategic plan to 2025, resolved to strengthen engagement with developing countries and foster regional cooperation. The Commission is supporting GEOSS activities in Africa through several projects based on earth observation, in particular to provide projection for food production and assessment of biological resources. The Commission will continue its research and innovation efforts to increase earth observation capacity in Africa (in particular in North Africa).

Cooperation also takes place on raw materials research and innovation diplomacy with the African Union.

Cooperation with Africa in ICT focusses on the co-design, adaptation, demonstration and validation (e.g. pilots) in of ICT related research and innovation, including in Content Technologies and Societal Challenges. To date, about €11 million worth of grants have been awarded in e-health, Big Data and geospatial data for land tenure. The ICT WP 2016-2017 call for "partnerships with to low and middle income countries" offers additional opportunities for cooperation with sub-Saharan Africa being one of the regions targeted and a total budget of €13 million.

3.2.3. *Framework Conditions*

There is concrete commitment on both sides to strengthen the overall cooperation framework in the field of science, technology and innovation. Several activities have been undertaken in support of the participation of entities established in Africa to Horizon 2020, namely training activities and information days were provided both to third country national contact points (NCPs) and to researchers and academics in African

⁵⁴ <http://www.ecorys.com/news/study-renewable-energy-and-research-and-innovation-capacity-sub-saharan-africa>

⁵⁵ www.edctp.org/

countries. In the future, the cooperation will continue to address the factors that are hampering the cooperation such as the low level of research intensity in most African countries, the low level of awareness about Horizon 2020, unequal access to information about cooperation opportunities, difficulties in finding European partners, institutional weakness, the uptake of research results and the visibility of successful collaborative research projects.

3.3. ASEAN

3.3.1. *The ASEAN as a partner of the EU*

ASEAN is the Association of Southeast Asian Nations composed of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. With a population of 622 million people, a GDP of 2,574 billion \$ and a GDP growth of 4.6%⁵⁶, ASEAN is emerging as one of the most rapidly developing regions of the world.

The ASEAN Economic Community (AEC), launched in late 2015, brings ASEAN to a new level of regional integration. Cooperation in research and innovation is administered now at regional level within the ASEAN secretariat under the pillar of Economic affairs. The recent ASEAN Plan for Action on Science, Technology and Innovation (APASTI, 2015-2020) and the ASEAN ICT Masterplan (2015-2020) lays out the principles and strategic activities for regional research and innovation policy.

The 2015 Communication to the European Parliament and the Council "The EU and ASEAN: a partnership with a strategic purpose" placed emphasis on Science, Technology and Innovation (STI) cooperation. Scientific cooperation is part of the partnership between the two regions since 2007 and has always featured in the context of the EU-ASEAN Ministerial Meetings. Cooperation of EU with the ASEAN countries in a variety of STI areas augments the capability to tackle challenges that are important for both regions and boosts their ability to compete in world markets.

3.3.2. *Priorities for S&T cooperation*

Priorities for EU-ASEAN cooperation address several areas:

In the area of food security and safety, sustainable aquaculture production has been a major challenge for both sides. The aim is to achieve common standards and legislation, create business opportunities and consolidate EU-Southeast Asia education and training networks.

In the area of nanotechnology, nano-safety and nano-measurements, cooperation is being undertaken through Nanoreg (regulatory testing of nanomaterials), of which Thailand became the first ASEAN member in 2014.

In the health area, cooperation is undertaken via multi-lateral initiatives, e.g. on infectious diseases through the Global Research Collaboration for Infectious Disease Preparedness joined by Thailand; on the International Cancer Genome Consortium that Singapore joined, and also via the Human Frontier Science Programme in 2014 of which Singapore is a member. In addition, there is potential to conduct joint research at regional level on antimicrobial resistance.

The priority for ICT-related research is innovative service creation based on existing technologies, with particular focus on the involvement of innovation stakeholders and end-user community representatives, e.g. through innovation hubs or "Living Labs". This has been translated in the ICT WP 2016-17 into a call for "partnerships with to low and middle income countries" with ASEAN being one of the regions targeted and a total budget of €13 million. It asks for the co-design, adaptation, demonstration and validation (e.g. pilots) of ICT related research and innovation in relevant thematic areas addressed by Horizon 2020 including Content Technologies and Societal Challenges.

⁵⁶ http://www.asean.org/storage/2015/11/ASEAN_Statistic_Leaflet_2015.pdf

Prospects in new areas for cooperation are also strong. For example, the management and sustainability of water resources and river systems, such as the Mekong, is an important priority for many countries in the region, in particular in connection to food security, energy and pollution in cities. Another example is the improvement of waste management, which offers opportunities not only in urban and industrial contexts but also with a view to reducing marine litter.

Maritime transport is another major challenge and will play a role in regional integration by addressing transport safety. Knowledge transfer from the EU can support better operational standards to improve safety and raise environmental standards.

3.3.3. *Framework Conditions*

Efficient framework conditions are a necessary step for establishing balanced and long-term cooperation. Research and innovation cooperation between the EU and ASEAN countries is being hampered by a wide range of factors ranging from the lack of substantial common resources among ASEAN Member States to implement actions at regional level, very low R&D investment in some of the countries and low public-private sector links. Nonetheless, the situation is changing as the region develops, with emerging opportunities for Europe to engage especially on R&I to address societal and global challenges.

Given the absence of R&I funding at regional level, a multilateral mechanism to support projects of common interest between Southeast Asia and the EU countries would be of substantial value. Such a scheme on the basis of a flexible “variable geometry” principle is currently the subject of a pilot action under the SEA-EU-net project⁵⁷, and was discussed at the latest EU-ASEAN Dialogue⁵⁸.

⁵⁷ <https://sea-eu.net/>

⁵⁸ <http://www.asean.org/chairmans-statement-of-the-16th-asean-ministerial-meeting-on-science-and-technology-ammst-16/>

3.4. CELAC

3.4.1. *CELAC as a partner of the EU*

The European Union and Latin America and the Caribbean have enjoyed privileged relations since the first bi-regional Summit in 1999, which established a strategic partnership. Since it was launched in 2010, the Community of Latin American and Caribbean States (CELAC) is the EU's counterpart in the bi-regional partnership.

The EU is the second trade partner for the CELAC region and also remains the leading foreign investor in CELAC countries.

Cooperation between the EU and CELAC in the field of Science, Technology and Innovation has been recognized as a very successful chapter under the overall EU-CELAC Partnership⁵⁹. The focus of cooperation has been on common challenges such as climate change and biodiversity, bioeconomy, energy, health and ICT. The EU-CELAC Summit in June 2015 called for a strengthened political framework for cooperation and moving towards a Common Research Area. At the 5th Senior Officials Meeting under the EU-CELAC Joint Initiative for Research and Innovation (JIRI) in March 2016, the Senior Officials confirmed their commitment to the implementation of the Common Research Area based on three pillars: mobility of researchers, access to research infrastructures and jointly addressing common challenges.

3.4.2. *Priorities for S&T cooperation*

Mobility of researchers will continue to be promoted by the European Research Council (ERC) via framework conditions to allow scientists to temporarily join research teams run by ERC grantees. Likewise, the Marie Skłodowska-Curie Actions continue to offer significant mobility opportunities in both directions, as proven by the significant number of researchers hosted by both CELAC and European organisations in the first two years of Horizon 2020.

The access to the 'Research Infrastructures' pillar will build on existing cooperation such as the joint venture, EULALINK, which was established in June 2015 to lay a transatlantic optic fibre cable from Portugal to Brazil with extensions to nearly all South American countries. The Commission supports a group of public actors (gathered in the consortium BELLA: Building European Link to Latin America⁶⁰) that can take advantage of the new capabilities offered with the objective to extend the cable's high capacity to other academic networks in Latin America, ensuring capillarity and equal access for academia and non-profit organisations in the region.

The installation of the trans-Atlantic submarine cable will offer opportunities to enhance joint development and access to Research Infrastructures in a number of scientific areas such as physics, cultural heritage, biodiversity and carbon cycle (in particular in connection with the LIFEWATCH infrastructure). Higher connectivity will increase opportunities for research infrastructures from Latin America to further develop links to European infrastructures and to participate in the 'Integrating Activities of the Research

⁵⁹ In addition to regional cooperation, 4 of the 33 CELAC countries have bilateral S&T Agreements with the EU (Argentina, Brazil, Chile and Mexico).

⁶⁰ BELLA is composed of 12 European and Latin American Research and Education Networks: RedCLARA (the Latin American regional network, leader in collaboration with GEANT), GEANT (the European regional network) and the networks from Brazil, Colombia, Ecuador, Peru, Chile, Portugal, Spain, France, Italy and Germany.

Infrastructure' part of Horizon 2020, which can fund the access of international users (Research teams) to European research infrastructures.

A mapping of existing research infrastructures in the CELAC region and an appropriate understanding of their regional capacity will allow the definition of strategic priorities for collaboration between the EU and CELAC.

Under the third pillar of the Common Research Area 'Jointly addressing common challenges' there is a wide range of on-going cooperation and considerable potential for more.

In the area of biodiversity and climate change, the Belmont Forum is an important platform through which the EU implements its international cooperation strategy. In 2016 it will implement two new collaborative research actions on 'Food, Water & Energy for Sustainable Global Urbanisation' and 'Transformations to sustainability'. In addition, an extension of ongoing Belmont Forum activities in the fields of e-Infrastructures (targeting open access to data and e-Infrastructures) and biodiversity are foreseen in the coming years. CELAC countries are encouraged to participate in the Belmont Forum and take advantage of the cooperation opportunities it offers.

Sustainable urbanisation is a shared priority of Europe and Latin America, focusing on common challenges such as pollution, loss of biodiversity, energy, waste and management, in connection with both environment protection - climate services and nature-based solutions for sustainable cities, such as risk prevention, as well as with food and agriculture resources -soil monitoring, water pollution impacts, etc.

In order to promote cooperation, the EU's 'Multi-stakeholder dialogue platform to promote innovation with nature' explicitly refers to fostering dialogue and collaboration with Latin-American partners.

Synergies are also being explored between Horizon 2020 and the EU Climate Change Regional Cooperation Programme for Latin America - EUROCLIMA⁶¹ to link policy making with research and innovation actions in the area of Knowledge Management for Climate Services.

In the area of health research, the recent outbreak of the ZIKA virus has shown that a network such as the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) is crucial in quickly gathering resources from both EU and CELAC. A dedicated Horizon 2020 call on ZIKA was launched in March 2016 to set up a research network across Latin America to facilitate, coordinate and implement urgent research against the ZIKA outbreak, and lay the foundation for a preparedness research network against future emerging severe infectious threats.

Other health topics of future cooperation concern primarily chronic diseases, infectious diseases and anti-microbial resistance. CELAC countries are encouraged to join the multilateral health initiatives through which the EU structures its international cooperation in these areas. In relation to chronic diseases, Mexico and Argentina have joined the Global Alliance for Chronic Diseases (GACD). Regarding infectious diseases Brazil, Mexico and Argentina have joined the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R). Argentina has also become an observer in the Joint Programming Initiative on Anti-Microbial Resistance⁶². The participation in these multi-lateral initiatives will allow CELAC countries to work closely with the EU (and other funding agencies) to coordinate investments in health research.

⁶¹ Under the Development Cooperation Instrument (DCI)

⁶² <http://www.jpiamr.eu/>

In the area of energy, despite the substantial bilateral cooperation with Brazil (biofuels) and Mexico (geothermal), the potential for cooperation in energy research with CELAC is currently underexploited. As a first step, the potential to develop ocean energy research in cooperation with Chile, Mexico and other CELAC countries is to be further explored.

In the area of ICT, the deployment of High Performance Computing is of key interest for EU-CELAC cooperation. Cooperation also focuses on innovative services with link to innovation stakeholders and end-user community representatives, e.g. through innovation hubs or “Living Labs”.

The EU's strategic partners for 'Raw Materials Diplomacy'⁶³ include several Latin American countries. The Horizon 2020 WP 2016-2017 on Raw Materials opens the door to CELAC participation, notably regarding a 'World Forum on Raw Materials' and an 'International network of raw materials training centres'.

Finally, several initiatives related to Smart Specialisation are being implemented in some regions of CELAC countries, notably in Argentina, Chile, Colombia, Peru, Mexico and Brazil, aiming at fostering regional competitiveness and economies, based in most of the cases on the EU experience in developing research and innovation smart specialisation strategies.

3.4.3. Framework Conditions

A positive step forward towards the improvement of the framework conditions for EU-CELAC cooperation are the Implementing Arrangements signed by the European Research Council with Argentina and Mexico in 2015. These allow scientists to temporarily join a research team run by an ERC grantee. Brazil, Peru, Colombia, Chile and Uruguay have also expressed interest in signing such arrangements. Significant progress has been made with Brazil in this regard.

⁶³ http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/international-aspects/index_en.htm