

# Roadmap for EU - South Africa S&T cooperation

## 1. SOUTH AFRICA AS A PARTNER OF THE EU

South Africa is one of the European Union's strategic partners. The EU and South Africa established a **Strategic Partnership** and adopted an Action Plan for its implementation in May 2007. The Action Plan has two strands: enhanced political dialogue and cooperation on regional, African and world issues, and stronger cooperation in a number of economic, social and other areas.

South Africa is the EU's largest trading partner in Africa. The EU is [South Africa's most important development partner](#), providing for 70% of all external assistance funds<sup>1</sup>. SA is very keen to enhance South-South relations, namely within IBSA (India-Brazil-South Africa) and BRICS. As the only African member of the G20, SA has also asserted itself as a key player representing both African interests and those of the "Global South"<sup>2</sup>.

*[Latest EU-SOUTH AFRICA Summit]*

The latest EU-South Africa Summit took place on 18 July 2013 in Pretoria. Both sides reaffirmed their commitment to the Strategic Partnership based on shared values and interests, including the promotion of peace and security, human rights, democracy, the Rule of Law and sustainable development across the two regions. At the Summit, cooperation in science, technology and innovation was heralded as a flagship of the Strategic Partnership evidenced by large-scale ongoing initiatives. Agreement was found to stepping up cooperation in selected thematic areas of mutual benefit to tackle global challenges jointly, to develop skills, to share knowledge, to create employment and stimulate growth. The next Summit is scheduled to take place in Brussels on 15 November 2018.

*[EU-SOUTH AFRICA non-S&T cooperation agreements]*

**The Trade, Development and Cooperation Agreement (TDCA)** constitutes the legal basis for the overall relations between South Africa and the EU. The TDCA covers political dialogue, the establishment of a free trade area over an asymmetrical twelve-year period, development co-operation, economic cooperation, and cooperation in a whole series of other areas. The agreement was signed in October 1999 and entered into force in 2000.

The EU and the countries of the southern African region, including South Africa, are engaged in Economic Partnership Agreement (EPA) negotiations, in the framework of which the EU has granted African, Caribbean and Pacific (ACP) countries duty-free, quota-free access to the EU's market.

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<sup>1</sup> <http://ec.europa.eu/trade/policy/countries-and-regions/countries/south-africa/>

<sup>2</sup> European External Action Service

Under the 2007-2013 EU Development Cooperation Instrument allocation for South Africa, EUR 30 million was allocated to an 'Innovation for Poverty Alleviation Programme', a sector policy support programme which focused on harnessing research and innovation as an instrument for poverty alleviation, in areas such as sustainable livelihoods, water, renewable energy and employment creation. Small businesses have been created in projects ranging from demonstration agronomy to ICT and renewable energy. Rural facilities and public schools were connected to internet through the Wireless Mesh Network and digital doorways have been installed throughout South Africa providing access to basic computer skills.

The Dialogue Facility<sup>3</sup> of the **Trade, Development and Cooperation Agreement** supported the establishment of an innovation policy dialogue and the development of a research and development infrastructure roadmap.

Under the EU-ACP Cooperation Programme on Science & Technology<sup>4</sup> phase I (EUR 35 million 2000-2007), 3 out of 36 projects financed are led by South African institutions (8%), 12 South African institutions participate in 8 out of 36 projects (22%). The main fields of involvement are biodiversity, agriculture and research management. In the second phase of the programme (EUR 23 million, 2008-2013) 1 of the 21 projects is led by a South African institution, with 5 institutions participating in one additional project.

South African researchers also participate in projects launched by the African Union Research Grants to which the EU has committed EUR 20 million (2008-2013). Themes include Agriculture, Energy, Water and Sanitation.

Regarding the Development Cooperation Instrument, the multi-annual indicative Programme for the period 2014-2020 focusses on three sectors taken from the National Development Plan of the Government of South Africa. These are (i) employment creation, (ii) education, skills development and innovation and (iii) building a capable and developmental state.

*[EU-SOUTH AFRICA S&T cooperation agreements]*

The **Science and Technology Cooperation Agreement** was concluded in 1996 and entered into force in November 1997. Scientific collaboration between South Africa and the EU is monitored and facilitated by the Joint Science and Technology Cooperation Committee (JSTCC), established under the Agreement. The last meeting took place in Pretoria on 6 December 2017 and reiterated the commitment of both sides to continue their good cooperation in various fields such as health, agronomic research and bio-economy, marine, and earth observation, while exploring new areas of collaboration, such as nanotechnology or innovative SMEs. The next meeting is foreseen in 2019.

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.

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<sup>3</sup> <http://www.dialoguefacility.org/>

<sup>4</sup> <http://www.acp-st.eu/fr/node/1192>

At bilateral level, SA has concluded S&T cooperation agreements with several EU member-states. South Africa is also a strong player in the EU-Africa High Level Policy Dialogue on science, technology and innovation, which is part of the Joint Africa EU Strategy and adopted at the Africa-EU Summit 2010.

[R&I landscape in SOUTH AFRICA]

SA's strategy on science and technology is governed by the South African R&D Strategy (2002) and the Ten-Year Innovation Plan (2008-2018). The National Research and Development Strategy (NRDS) takes an 'integrated approach, which includes human resource development, knowledge generation, investment in science and technology infrastructure, and improving the strategic management of the public science and technology system'<sup>5</sup>. The Ten-Year Innovation Plan (TYIP) aims to drive South Africa into a knowledge-based economy, 'in which the production and dissemination of knowledge will lead to economic benefits and enrich all fields of human endeavour'<sup>6</sup>.

As regards South Africa's investment in R&D, its intensity in 2012 was 0.73% of GDP, almost one percentage unit less than the global one (1.7%), but higher than the average African one (0.45%)<sup>7</sup>. With reference to SA's share of global researchers, the percentage between 2007 and 2012 has been steady at 0.3%<sup>8</sup>. Figure 1 shows that the SA expenditure in R&D as a percentage of GDP has approximately been the same ( $\approx 0.7$ ) between 2005 and 2015, whereas the number of researchers per million inhabitants seems to be slightly higher in 2015 than 2005. Between 2008 and 2014 there has been a 65.9% growth in internationally co-authored publications with authors from South Africa, a figure slightly above the general trend of rising number of internationally co-authored publications with authors from Africa (60.1%)<sup>9</sup>. South Africa produces publications with a citation impact higher than the EU average in fields such as medicine (general medicine, cardiology and cardiovascular medicine, immunology and allergy, infectious diseases), arts and humanities (history) and social sciences (cultural studies)<sup>10</sup>, although with a high share of international co-publications (see Figure 3 in Annex). Data on patents submitted to UPSTO show that SA's share is among the highest in Africa, as it accounts for 190 out of the total of 303 submitted from Africa<sup>11</sup>; Finally, the country's specialisation index compared to EU28, based on PCT patents, seems to have an upward trend in areas such as pharmaceuticals, biotechnology and ICT (OECD classification) as well as control and telecommunications (WIPO classification) (2014, see Figure 4 in Annex).

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<sup>5</sup> SAccess. *Supporting the EU access to South Africa's research and innovation Programmes*. Retrieved from: [http://www.esastap.org.za/download/sa\\_ri\\_capacity.pdf](http://www.esastap.org.za/download/sa_ri_capacity.pdf)

<sup>6</sup> South Africa, Department of Science and Technology. *Ten-Year Innovation Plan*. Retrieved from: [http://www.esastap.org.za/download/sa\\_ten\\_year\\_innovation\\_plan.pdf](http://www.esastap.org.za/download/sa_ten_year_innovation_plan.pdf)

<sup>7</sup> UNESCO. (2015). *Unesco Science Report*, pp. 26-27

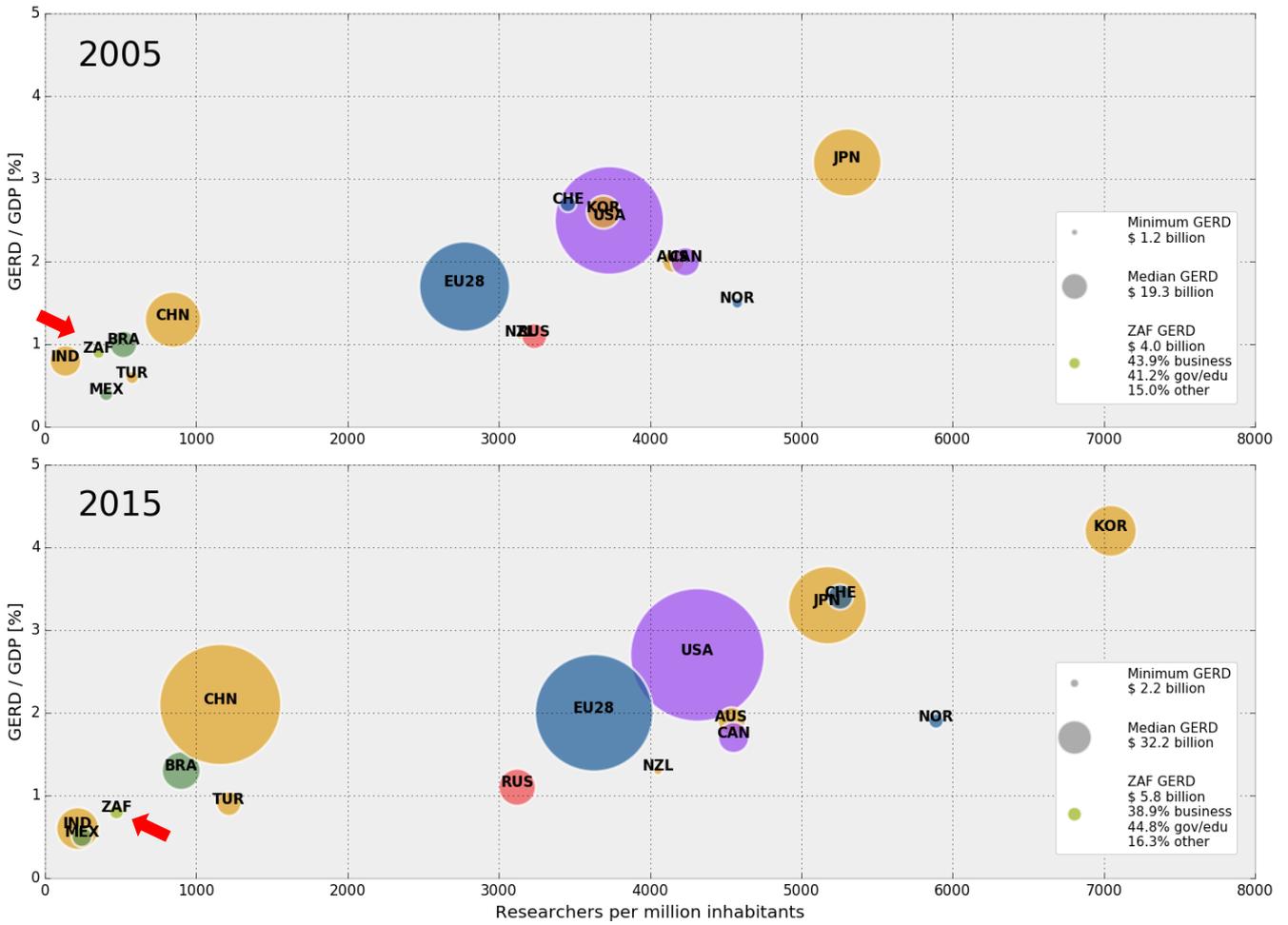
<sup>8</sup> *Ibid.*, pp. 32-33

<sup>9</sup> UNESCO. (2015). *Unesco Science Report*, pp. 36-37

<sup>10</sup> These are among areas with high share of publications in the country's total output of publications.

<sup>11</sup> *Ibid.*, p. 38

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



Note: GERD in current PPP; Top chart: Data for CHE from 2004. Bottom chart: Data on researchers per million inhabitants for BRA from 2014, for CAN from 2014, for MEX from 2013 and for AUS from 2010.

Source: DG RTD - International Cooperation

Data: UIS, OECD, EUROSTAT; extraction date: 11/10/2018

## 2. STATE OF PLAY OF EU-SOUTH AFRICA S&T COOPERATION

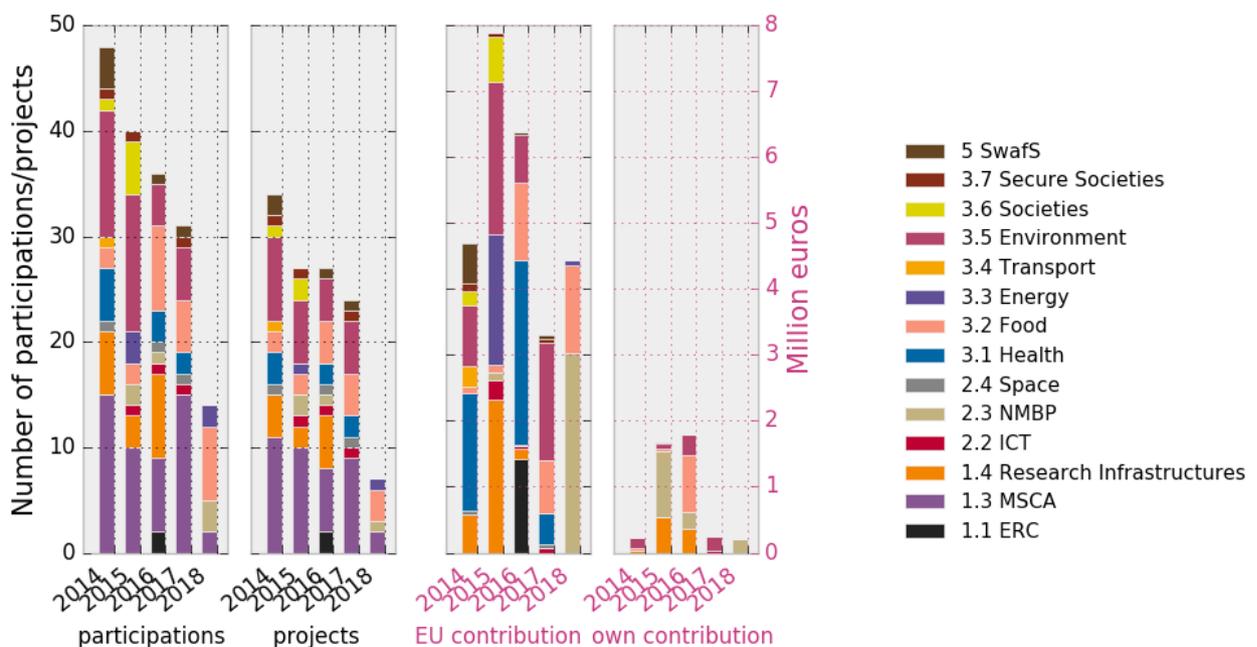
### 2.1. On-going FP7 and Horizon 2020 cooperation

In **FP7** South African entities have participated 313 times to 249 grants of collaborative, ERC and MC actions of FP7, receiving 38.1 million euros from the EU while 17.2 million euros is the non-EU budget. Under the Euratom FP7 Research programme there were six South African participations to the fission energy projects on waste management, co-generation and G-IV systems. In addition, 470 researchers of ZA nationality have participated in Marie-Curie actions and 1 ZA national has acquired an ERC grant.

As far as **Horizon 2020** is concerned, up to October 2018 South African entities have participated 169 times to 119 signed grants of Horizon 2020, receiving 26.9 million euros of EU contribution while 4.3 million euros is the non-EU budget of South African beneficiaries. In addition, 105 researchers of ZA nationality have participated in Marie Skłodowska Curie Actions and one ZA national has acquired an ERC grant. In terms of total participations, South Africa is 5<sup>th</sup> after USA, China, Canada and Australia.. In terms of EU funding South Africa is 2<sup>nd</sup> after the USA. In terms of success rates of applicants, South Africa is 8<sup>th</sup> among the most active non-associated countries, with success rate close to 20%, well above average

Figure 2 depicts the participation of South Africa in Horizon 2020 between 2014 and 2018. Marie Skłodowska Curie Actions, Research Infrastructures and Environment are among the dominant areas of cooperation.

**Figure 2: Participation of South Africa in Horizon 2020**



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

## 2.2. Current framework conditions for EU-SOUTH AFRICA S&T cooperation

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 raising awareness of 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. Among other events and meetings, Horizon 2020 was officially launched in South Africa in January 2014. Most South African research programmes are currently being accessed only by South African researchers and funding is only for South Africans. There is, however, willingness in some research managing organisations to open up their programmes to European researchers.

The bilateral STI dialogue between the EU and South Africa has been supported, since 2005, by the EU-funded project 'ESASTAP' (*Europe-South-Africa S&T Advancement Platform*) and its successors (the EU has supported four phases in total). Aimed to support the participation of South-African scientists and other stakeholders in the successive Framework Programmes, the platform has organised, inter alia, workshops along the themes of the FP, trainings involving national thematic NCPs, EU-South Africa networking conferences, online searching tool for FP partners, etc.

A remaining problem lies in the commercialisation of research results. South Africa has been a WTO member since 1995 and a signatory to the TRIPS Agreement that resulted in expanded commitments to internationally binding guarantees of intellectual property rights. Furthermore, there are more than 30 pieces of legislation, such as the IPR from publicly financed R&D Act, the Biodiversity Act and the R&D Tax Incentives in South Africa that directly impact the National System of Innovation. South Africa ranks 58 out of 142 countries in the WIPO Global Innovation Index 2013. South Africa leads the dynamic Southern African Research and Innovation Managers Association (SARIMA) which is active in promoting and facilitating the management of Research and Innovation.

## 3. Priorities for the future in S&T cooperation

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

- The second phase of **the European and Developing Countries Clinical Trials Partnership**<sup>12</sup> (EDCTP) is working with a budget of nearly € 2 billion (2014-2024), of this € 683 million comes from Horizon 2020. Today 14 African countries and 14 Member States of the EU are part of EDCTP2. South Africa, as a member of EDCTP2, will continue to cooperate with the EU and EDCTP2 members against infectious and parasitic diseases, such as AIDS, tuberculosis, malaria, sleeping sickness, hookworm diseases and Ebola.
- South Africa and the EU cooperate in **multilateral health research initiatives** which aim to address global health challenges, such as the Global Alliance for Chronic Diseases<sup>13</sup> and the Global Research

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<sup>12</sup> <http://www.edctp.org/>

<sup>13</sup> [www.gacd.org](http://www.gacd.org)

Collaboration for Infectious Disease Preparedness<sup>14</sup>, in which both South Africa and the European Commission participate as members. Cooperation also takes place in the Global Tuberculosis Vaccine Partnership (GTBVP), in which the Medical Research Council and the Department of Science and Technology of South Africa are co-chairs of the GTBVP Working Group.

- The EU and South Africa have a good level of cooperation in the domain of **Research Infrastructures** e.g. in the domain of radio-astronomy and astro-particle physics. South Africa is one of the major players in the Square Kilometre Array (SKA) ESFRI roadmap project and has already designed and built the MeerKAT telescope as a pathfinder to the SKA. South Africa is also an active member of the Group of Senior Officials (GSO) on global Research Infrastructures for which it has taken the chairmanship as of October 2016. In the next years, the EU will continue supporting the development of the Square Kilometre Array until mid-2017 through a dedicated grant signed at the end of 2015.
- In October 2016, South Africa hosted, with the support of the European Commission, the 3<sup>rd</sup> Edition of the **International Conference on Research Infrastructures** which was held for the first time outside the borders of the EU.
- South Africa, has set out a clear **Earth Observation** Strategy and possesses world class infrastructure and excellence. It is an active member in several EO-related international forums such as the Group on Earth Observations (GEO<sup>15</sup>), which it co-chairs together with the European Commission. The focus will be on supporting the implementation of the new GEOSS 10 year strategic plan and AfriGEOSS, the African segment of GEOSS (Global Earth Observation System of Systems). AfriGEOSS aims to provide the necessary framework for African countries and organisations as well as international partners to access and leverage on-going local and international bilateral and multilateral EO-based initiatives across Africa, thereby creating synergies and minimising duplication for the benefit of the continent. The EC and South Africa are also involved in the development of an Integrated Atlantic Observing System.
- South Africa is actively involved in the ERANET COFUND Waterworks2015. WaterWorks2015 aims at pooling resources from the 32 participating research programme owners / managers of 23 countries to implement a joint call for proposals, with EU co-funding in the area of **sustainable water use in agriculture and forestry**. It is a collaboration between the Joint Programming Initiatives (JPIs), “Water Challenges for a Changing World” and “Agriculture, Food Security and Climate Change”.
- South Africa is a partner in the ERANET ERAMIN on **mining and minerals research and innovation**. South Africa is a supplier of raw materials to the EU, has a likeminded approach to free trade and is technologically advanced.
- Good cooperation exists between SA and the EU in the field of **ICT**, both bilaterally and in the framework of the Joint Africa-EU Strategy.

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<sup>14</sup> [www.glopid-r.org](http://www.glopid-r.org)

<sup>15</sup> [http://www.earthobservations.org/about\\_geo.shtml](http://www.earthobservations.org/about_geo.shtml)

- South Africa participates actively in the EU-Africa Research and Innovation Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA)<sup>16</sup>, launched in April 2016. Through this initiative, South Africa together with other partners from Europe and Africa focus their research collaboration in areas such as sustainable intensification, agriculture and food systems for nutrition and agricultural markets and trade.
- Cooperation will be stepped up in the domain of nanotechnology safety with a workshop arranged at a strategic level to be organised towards the end of 2017. Managing the potential risks of nanotechnologies is a must for secure deployment of these new technologies. This necessitates global efforts, including collaboration between the EU and South Africa.

### 3.2. Potential new areas of future S&T cooperation proposed at latest Joint Committee/High Level Dialogue, through SFIC, or by thematic services

- Atlantic Ocean research cooperation is one of the main developing areas of joint interest. In parallel with the ongoing North Atlantic cooperation, we have taken significant steps towards an All Atlantic Ocean Research Alliance. The European Commission and South Africa have signed a Declaration of Intent<sup>17</sup> on marine research and innovation cooperation in October 2016. This Declaration is similar to the one already signed with Brazil in October 2015<sup>18</sup>.
- In parallel, South Africa and Brazil signed a joint document on South-South Atlantic research cooperation in October 2015 aiming at developing a South Atlantic Science Plan. It also involves other South Atlantic countries, such as Namibia, Angola, Argentina and Uruguay. On 13 July 2017 these efforts led to the signing by the EU, Brazil and South Africa of a joint [Statement on Atlantic Ocean Research and Innovation Cooperation](#) and the launch of the South Atlantic Research and Innovation Flagship Initiative..
- The South African National Research Foundation is the only African research & innovation funding agency that is a member of the **Belmont Forum** which supports multi-national collaborative projects which address some of the grand research challenges in areas such as food security, ecosystem services, freshwater security, and coastal resilience. The Belmont Forum strongly adheres to open access to research data principles. For the EU & Associated States, the EC (H2020) and funding agencies from France, Germany, Italy, the Netherlands, Sweden and the UK are members. The EU-South Africa Partnership could gain from more African Research and Innovation funding agencies becoming member of the Forum.
- Building on South Africa's participation in the EU-Africa R&I Partnership on FNSSA, further synergies will be sought in the framework of the African Union-European Union R&I Partnership on Climate Change and Sustainable Energy, especially in the areas of climate action for adaptation and mitigation, renewable energy and energy efficiency.

<sup>16</sup> [http://ec.europa.eu/research/iscp/pdf/policy/eu-africa\\_roadmap\\_2016.pdf#view=fit&pagemode=none](http://ec.europa.eu/research/iscp/pdf/policy/eu-africa_roadmap_2016.pdf#view=fit&pagemode=none)

<sup>17</sup> <http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2016&na=na-041016>

<sup>18</sup> [https://ec.europa.eu/research/bioeconomy/pdf/declaration\\_of\\_intent.pdf](https://ec.europa.eu/research/bioeconomy/pdf/declaration_of_intent.pdf)

- 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. Future Earth is evolving into a virtual interface for scientists from all over the world and has the potential of becoming a prominent context for EU and non-EU researchers, research bodies and research funding agencies exchanging STI visions with each other. Although a regional hub in Africa is being established, Africa is still under-represented in this initiative.
- Establish a dialogue between SA and the EU on the issues of **Research Infrastructure roadmap development**. ESFRI Research Infrastructures are continuously building cooperation links with SA, through platforms such as AERAP or projects such CTA and SKA, but also in areas such as Biobanking and Biomedical research, Virology, and Clinical Trials, which can constitute an opportunity to ensure a stronger synergy between the ESFRI roadmap and the SA roadmap.
- Building on South Africa's involvement in the ERANET ERAMIN on mining and minerals research and innovation, cooperation is also being sought in the context of the **European Innovation Partnership on raw materials**.
- Further discussion could take place on the **South-African Bioeconomy Strategy**. Dialogue can take place in an effort to seek complementarities for mutual benefit in the areas of enzyme development, energy crops, biofuels, animal vaccine development, including at a later stage the EU bio-based industries Joint Undertaking and the International Bioeconomy Forum.
- Cooperation with South Africa in the domains of **Concentrated Solar Power, Carbon Capture and Storage, Renewable Energy and Fuel Cells and Hydrogen** could be explored.

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

- Enhanced communication on Horizon 2020 rules for participation (in both EU and SA);
- Showcasing successful partnerships (to address perception issues);
- Leveraging bilateral cooperation with EU Member States and Associated Countries

**Annex:**

**HORIZON 2020 WORK PROGRAMME 2018-20 TOPICS EXPLICITLY ENCOURAGING COOPERATION WITH SOUTH AFRICA**

	<b>Topic identifier</b>	<b>Topic title</b>
<b>2018</b>	BG-08-2018-2019	All Atlantic Ocean Research Alliance Flagship
	NMBP-13-2018 (closed)	Risk Governance of nanotechnology (RIA)
	NMBP-14-2018 (closed)	Nanoinformatics: from materials models to predictive toxicology and ecotoxicology (RIA)
<b>2019</b>	MIGRATION-08-2019	International protection of refugees in a comparative perspective
	NMBP-15-2019	Safe by design, from science to regulation: metrics and main sectors (RIA)
	SU-SPACE-22-SEC-2019	Space Weather

Cooperation could also be encouraged through the 'EURAXESS WORLDWIDE implementation' action, aiming to link Europe to the rest of the world and to promote international collaboration of researchers, mobility and career development. South Africa could be among the countries where a new office could be opened during the implementation phase of the framework contract.

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

	Scientific Area	Share in world output	Share of international co-publications	Citation Impact	
				Difference with EU28	8-year trend
<b>High publication output</b>	Medicine: General Medicine	0,5%	53%	+1.15	↑
	Arts and Humanities: History	0,8%	15%	+0.86	↓
	Medicine: Cardiology and Cardiovascular Medicine	0,3%	52%	+0.35	↑
	Social Sciences: Cultural Studies	1,0%	13%	+0.29	↓
	Engineering: Control and Systems Engineering	0,3%	39%	+0.16	↑
	Medicine: Immunology and Allergy	0,9%	66%	+0.15	↓
	Environmental Science: General Environmental Science	0,8%	51%	+0.13	↑
	Medicine: Infectious Diseases	2,3%	73%	+0.09	↓
	Veterinary: General Veterinary	1,0%	58%	+0.07	↑
	Chemical Engineering: General Chemical Engineering	0,5%	51%	+0.06	↑
<b>Low publication output</b>	Social Sciences: Archeology	1,7%	42%	+2.01	–
	Arts and Humanities: Visual Arts and Performing Arts	0,2%	15%	+1.26	–
	Chemical Engineering: Fluid Flow and Transfer Processes	0,4%	37%	+1.21	↑
	Arts and Humanities: Archeology (arts and humanities)	1,4%	38%	+1.2	↓
	Social Sciences: Gender Studies	0,7%	24%	+1.06	–
	Pharmacology, Toxicology and Pharmaceuticals: General	0,4%	69%	+1.02	–
	Social Sciences: Urban Studies	1,2%	22%	+1.0	↑
	Medicine: Pulmonary and Respiratory Medicine	0,7%	73%	+0.86	↑
	Medicine: Physiology (medical)	0,3%	61%	+0.73	–
	Earth and Planetary Sciences: Computers in Earth Sciences	0,9%	55%	+0.66	–

Source: DG Research and Innovation – International Cooperation

Data: Elsevier SciVal; extraction date: 6/8/2017; publications' window: 2011-2013; citations' window: 3 years

Note: These tables show scientific areas in which the country's academic publications have a higher citation impact than EU28, and whether this difference has decreased, increased or remained the same in the past 8 years. They are grouped in two tables. The top table focuses on areas with high share of publications in the country's total output of publications and the bottom table on those with low share of publications. Scientific areas are based on Elsevier 'All Science Journal Classification'. For each area, the country's share in the world output of publications and the share of international co-publications are also shown.

**Figure 4: South Africa – Specialisation compared to EU28 in selected technologies based on PCT patents**

	Technology	2014 PCT patents	2014 PCT patents of EU28	2014 Specialisation compared to EU28	8-year trend
<b>OECD classification</b>	Pharmaceuticals	18	2.524	1,32	↑
	Biotechnology	20	2.745	1,29	↑
	ICT	78	14.579	0,96	↑
	Selected environment-related technologies	16	3.663	0,80	↓
	Medical technology	15	3.879	0,70	↓
	Nanotechnology	0	137	0,00	↓
<b>WIPO classification</b>	IT methods for management	12	425	4,69	↓
	Civil engineering	26	1.632	2,65	↓
	Control	10	784	2,12	↑
	Micro-structural and nano-technology	1	86	1,93	–
	Environmental technology	8	716	1,86	↓
	Telecommunications	8	749	1,77	↑
	Food chemistry	5	484	1,72	↑
	Pharmaceuticals	16	1.581	1,68	↑
	Other special machines	16	1.692	1,57	↑
	Furniture, games	9	952	1,57	↓
	Analysis of biological materials	4	426	1,56	–
	Thermal processes and apparatus	7	791	1,47	↑
	Audio-visual technology	6	761	1,31	↑

Source: DG Research and Innovation – International Cooperation

Data: OECD (top table) WIPO (bottom table); extraction date: 6/8/2017

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