European Commission

# Roadmap for EU – India S&T cooperation

## 1. INDIA AS A PARTNER OF THE EU

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. With a population of 1.3 billion people, 50% of which are under 25 year old, a GDP of €1543 billion, and a GDP per Capita of €1225, India is the 9th largest trade partner for the EU and an emerging global economic power. The value of EU-India trade grew from €28.6 billion in 2003 to €77.5 billion in 2015; trade in commercial services quadrupled in the past decade reaching €24.4 billion in 2014. In 2015 EU exports of goods to India amounted to €38.1 billion, whereas imports from India totalled €37 billion. Indian investments in the EU reached €9 billion in 2013, while EU investments in India amounted €38.5 billion over the same period.[1]

[*Latest EU-INDIA Summit*]

The 13th Summit between the European Union and India took place in Brussels on 30 March 2016. The leaders reconfirmed their commitment to give new momentum to the bilateral relationship endorsing the **EU-India Agenda for Action 2020**[2] as a common roadmap to jointly guide and strengthen the India-EU Strategic Partnership in the next five years. It encompasses a wide range of areas for cooperation such as foreign and security policy, trade and investment, economy, and global issues.

The summit was also the occasion to welcome the substantial progress made in the EU-India cooperation in research and innovation, including the outcome of the 10th Joint Scientific and Technological Cooperation Committee (JSTCC) in November 2015. For instance, leaders welcomed the extension of the India-EU Science and Technology Cooperation Agreement until 2020 and reaffirmed their shared commitment to research and innovation as drivers of social and economic development. Furthermore, the EU and India agreed to intensify their cooperation in S&T and in addressing global challenges including health, and welcomed the setting up of mechanisms for jointly financing research and innovation projects.

[*EU-INDIA non-S&T cooperation agreements*]

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. To underpin that *Strategic Partnership*, the 2005 Summit adopted the *EU-India Joint Action Plan* (the 'JAP') which defined common objectives and proposed a wide range of supporting activities in the areas of political, economic, sectorial and development co-operation. It was updated in 2008.

The EU and India have been negotiating an ambitious Free Trade Agreement since 2007, covering effective market access and investment. Substantial progress has been made, however progress is needed in improved market access for some goods and services, government procurement, geographical indications and sustainable development.

[1] http://ec.europa.eu/trade/policy/countries-and-regions/countries/india/
http://eeas.europa.eu/factsheets/docs/eu-india_factsheet_en.pdf
[2] http://europa.eu/rapid/press-release_IP-16-1142_en.htm

Political cooperation covers a wide range of international concerns such as security (non-proliferation/disarmament, counter-terrorism, counter-piracy, cyber-security), international political issues (in particular South Asian region, the EU neighbourhood and the Middle East), energy, environment, and climate change.

Human rights are addressed in the annual *EU-India Human Rights Dialogue* held locally in India. The EU is the only partner with which India has a bilateral human rights dialogue.

[*EU-INDIA S&T cooperation agreements*]

Research and Innovation is one of the areas where EU-India collaboration has expanded significantly since 2001 when the first *Agreement on the Scientific and Technological Cooperation* was signed. It was renewed in 2007 and 2016. In addition, the *Agreement between the European Atomic Energy Community (Euratom) and the Government of the Republic of India in the field of Fusion Energy Research* is in force since 2010. India and Euratom are also cooperating constructively within the ITER, the *International Thermonuclear Experimental Reactor*.

A *Joint Declaration on Research and Innovation Cooperation* was signed in 2012. Based on this declaration a EU/MS-India Ministerial meeting in June 2012 was held where the *Indo-European R&I Partnership* was agreed upon in the so-called Brussels communiqué together with the *Group of Senior Officials* (GSO) structure. The GSO met for the first time in 2013. The 2015 EU-India *Joint Steering Committee* meeting reinforced the Partnership by agreeing on further developing cooperation in areas of mutual interest.

[*R&I landscape in INDIA*]

India's R&I landscape is 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 Institute of Technology. The country is also experiencing a surge in its share of the world's high-quality scientific publications[3]. 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 patents. The expansion of the top layer of federal higher education institutions performing research continues. Since 2006, six Indian Institutes of Science Education and Research (IISERs) have been established, with a mandate to perform frontier research in basic sciences. The group of the more engineering and applied sciences oriented Indian Institutes of Technology (IITs) was also expanded (from 16 in 2014 to 18 in 2015 and 23 in 2016). The majority of R&D personnel, however, continues to be employed in public research institutions such as the Council of Scientific and Industrial Research (CSIR) or Ministries like the Department of Biotechnology (DBT), the Department of Atomic Energy (DAE), etc. The majority of higher education institutions focus on teaching and are not very active in research. It is the case for most of the 750 universities; the exceptions are the IISERs, the IITs, the Indian Institutes of Management (IIM), the All India Institutes of Medical Sciences (AIIMSs), the Indian Institute of Science, the Energy and Resources Institute (TERI), the Tata Institute of Fundamental Research and around 20 major central universities.

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. India hosts several top corporate R&D investors in automotive, industrial machinery and IT industries. 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 by the private sector. More than half of it relates to the defence, space and nuclear sectors.

[3] http://www.natureindex.com/pdf/news/indian-science-ascending.pdf

The Indian government announced in January 2013 the Science, Technology and Innovation Policy 2013 (STIP 2013). STIP 2013 is a step forward in attempting to forge links between science, technology and innovation in the policy framework. STIP 2013 aims to enhance the role of the private sector in the national science, technology and innovation system in a public-private partnerships (PPP) mode, towards attaining the target of 2% of GDP in research and development (R&D). India has adopted inclusive and affordable innovation as part of its innovation strategy. [4,5]

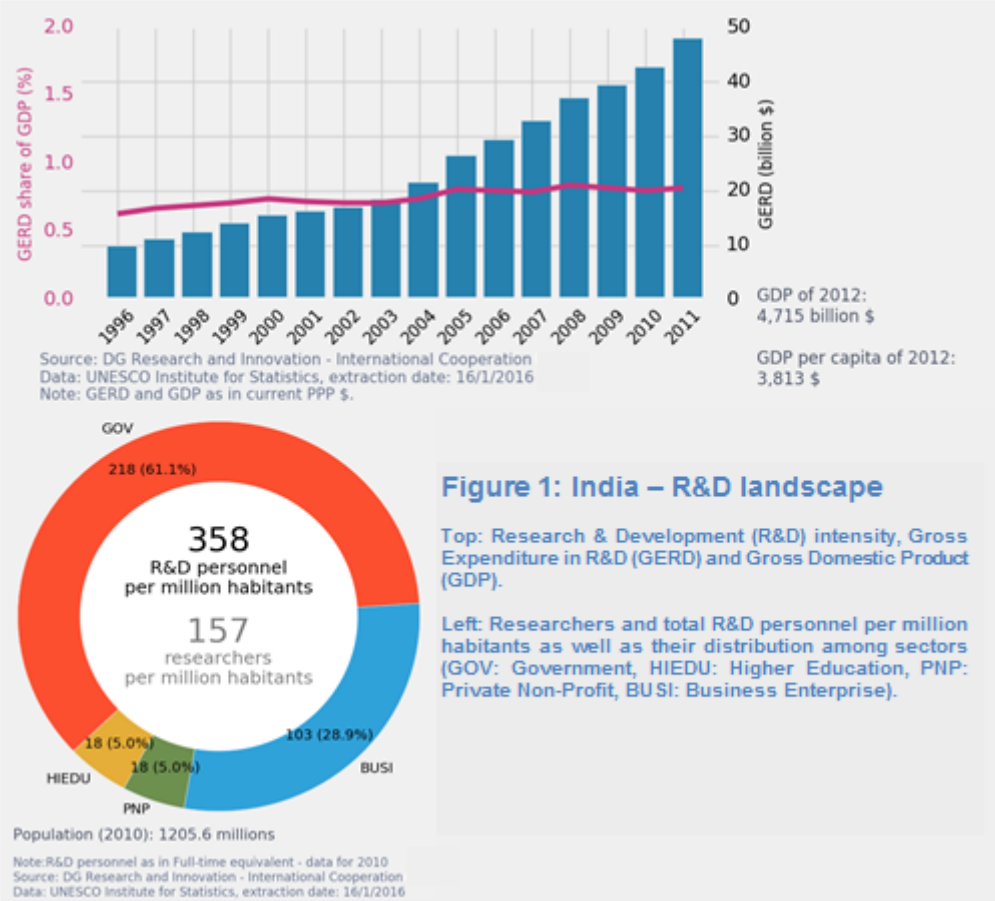


**Figure 1: India – R&D landscape**

Top: Research & Development (R&D) intensity, Gross Expenditure in R&D (GERD) and Gross Domestic Product (GDP).

Left: Researchers and total R&D personnel per million habitants as well as their distribution among sectors (GOV: Government, HIEDU: Higher Education, PNP: Private Non-Profit, BUSI: Business Enterprise).

[4] http://www.nature.com/news/india-by-the-numbers-1.17519

[5] http://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/india.htm

## 2. State of play of EU-INDIA S&T cooperation

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

In FP7 collaborative projects, there were 264 participations of entities from India. Indian participants have received €37.5 million from the European Commission. Projects were funded in the fields of Energy, notably in wind energy, energy efficiency, synthetic and second generation biofuels, coal mine methane drainage, and gasification of coal; Environment including climate change and water; Health; ICT; Nanoscience; Socio-economic research; and Food and agriculture.

Five coordinated calls were launched with India under FP7, resulting in more than 18 joint projects, with co-investments of about €30 million from each side in areas relating to Computational Material Science, Food and nutrition research, Solar Energy systems research, Partnering initiative on biomass and bio-waste, and Water related challenges.

Several joint collaborative projects funded by MS funding agencies were also launched under the NEW INDIGO ERA-NET and its successor INNO INDIGO[6].

Up to October 2016, Indian applicants are involved 73 times in 59 eligible proposals to collaborative[7] actions. 10 proposals were mainlisted, leading to a success rate of 16.9% (as compared to 15.5% for non-associated countries and 12.7% overall). Indian entities have 12 participations in 10 signed grants, receiving 1.3 million euros from EU.

Under the Euratom FP7 research programme, India participated in two fission projects. Under the bilateral cooperation agreement on fusion energy research, around 20 bilateral activities between Indian and European labs are on-going, with three projects related to the *Joint European Torus* (JET), implemented by a bilateral *ad hoc* Task Force.

A certain degree of collaboration between European and Indian Research Infrastructures has been going on throughout the years. India is in the process of becoming an associated member of CERN and is already associated to a number of European Research Infrastructures, such as the Square Kilometre Array (SKA) radio telescope and the Facility for Antiproton and Ion Research (FAIR). India is also an active member of the Group of Senior Officials (GSO) on global Research Infrastructures (RI) in which context it has been seeking international partners for its underground laboratory (the India-based Neutrino Observatory – INO).

The Joint Research Centre (JRC) of the European Commission supports India through regional and multilateral initiatives, such as the Atlas of Regional Water Cooperation and Conflicts, and the Integrated Drought Management Programme (IDMP); JRC's Global Flood Awareness System is serving as an example of successful cooperation between Asia and Europe.

[6] https://indigoprojects.eu/

[7] Here referring to non-bottom-up, internationally open, collaborative actions, i.e. all actions except for ERC, MSCA, actions under the SME Instrument and Access to Risk Finance.

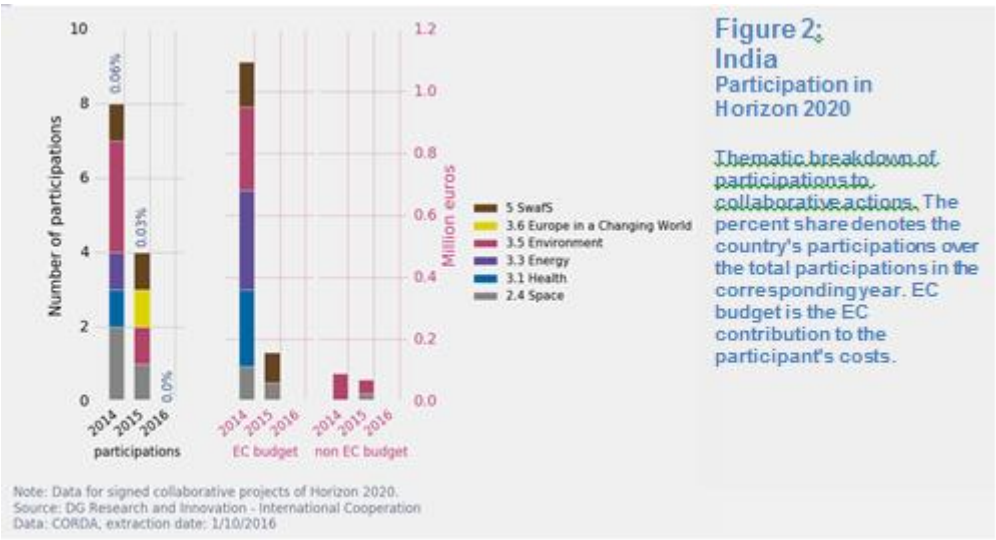


**Figure 2: India**
**Participation in Horizon 2020**

Thematic breakdown of participations to collaborative actions. The percent share denotes the country's participations over the total participations in the corresponding year. EC budget is the EC contribution to the participant's costs.

## 2.2 Current framework conditions for EU-INDIA S&T cooperation

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 departments.

Mobility of researchers is promoted through the EU's *Marie Skłodowska-Curie* (MSCA) Research Fellowship Programme. India has a strong track record in the Marie Curie actions (2007-2013) and is the second country in number of researchers funded in Marie Curie actions after China with a total of 1680 researchers (exchanged staff (IRSES) included). 97 Indian organisations participated in the MCA within a total of 75 projects.

The Marie Skłodowska-Curie actions (MSCA) part of Horizon 2020 (2014-20) continues to offer diverse opportunities for EU-India scientific cooperation. In the first calls under Horizon 2020, 210 Indian researchers have been funded under MSCA: 207 individual ones (in ITN, COFUND and IF projects) and 3 staff members (through RISE projects). Furthermore, there are 6 entities from India that participate in the MSCA RISE programme, 3 that participate in ITN programmes and 3 in COFUND.

# 3. Priorities for future S&T cooperation

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

At the 2015 *EU-India Joint Steering Committee* meeting the two sides agreed to 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 Bio-economy, Nanotechnologies, and Advanced Materials.

EU and India cooperate well in the frame of the multi-lateral initiative on chronic diseases, in particular with GACD, the *Global Alliance for Chronic Diseases*. Since the EU joined GACD (India was already a member), calls have been launched on areas such as diabetes type 2 and lung diseases. Cooperation will continue in the future on different chronic diseases such as mental health.

On fusion cooperation, both sides agreed at the second *Euratom-India Coordinating Committee* meeting (CC-2), to share knowledge and understanding of the respective fusion programmes and strategic roadmaps, ITER constituting the main benchmark for both Parties. The main area of cooperation is the potential India partnership in the JET programme. The two sides agreed to establish a bilateral *'Task Force on the JET ELM coils project'* that in 2015 performed its goals. The Mapping of bilateral collaborative activities that covers all collaborations between European and Indian labs is a rolling action.

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

The EU encouraged Indian participation in health research within multi-lateral platforms such as the *Global Research Collaboration for Infectious Diseases Preparedness* (GloPID-R)[8] and the *International Initiative for Traumatic Brain Injury*[9]. One of the important interlocutors on health research is the *Department of Biotechnology* (DBT), which has committed to cooperate on anti-microbial resistance in the frame of the *Joint Programming Initiative* on Anti-Microbial Resistance (JPI AMR)[10].

Reinforced cooperation with DBT in the area of Global Health is also envisaged as announced at the EU-India Summit of March 2016; Cooperation in the field of Water should also be strengthened; and negotiations are ongoing to allow India to join the *Water Joint Programming Initiative* (JPI WATER)[11].

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.

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.

The European Research Council will continue to seek interested partner organisations in India, in order to establish arrangements that will allow scientists from this country to spend some time with an ERC supported research team in Europe.

[8] http://www.glopid-r.org
[9] http://intbir.nih.gov/
[10] http://www.jpiamr.eu
[11] http://www.waterjpi.eu/

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

To support the participation of entities established in India in Horizon 2020 collaborative projects, a *co-funding mechanism* has been agreed with the *Department of Biotechnology* (DBT)[12] covering all areas related to biotechnology: Health, Agriculture, Food Security, Bio-economy and Bioenergy; and with the Department of Science and Technology (DST)[13] covering the field of Nanotechnologies. A similar mechanism is being negotiated with the Department of Electronics and Information Technology (DeitY)

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.

[12] http://www.dbtindia.nic.in/wp-content/uploads/DBT-EU-calls-under-H2020-.pdf

[13] http://dst.gov.in/sites/default/files/DST-EC-Call%20note-co-funding-2016-DST-version-%282%29-revised-100816-clean.pdf

**ANNEX: HORIZON 2020 WORK PROGRAMME 2016-17 TOPICS EXPLICITLY ENCOURAGING COOPERATION WITH INDIA**

| | Topic identifier | Topic title |
|---|---|---|
| **2016** | INFRAIA-01-2016/2017 | Integrating Activities for Advanced Communities |
| | MG-3.5-2016 | Behavioural aspects for safer transport |
| **2017** | INFRAIA-01-2016/2017 | Integrating Activities for Starting Communities |
| | MG-3.2-2017 | Protection of all road users in crashes |

EURATOM WORK PROGRAME 2016-17 TOPICS EXPLICITLY ENCOURAGING COOPERATION WITH THE AFRICAN UNION

| | Topic identifier | Topic title |
|---|---|---|
| 2016 | EURATOM India Fusion CA | Partnership in JET programme |
| 2017 | | Mapping of bilateral fusion collaborative activities |

## Table 1: India - Top subdisciplines by Field-Weighted Citation Impact

| Major Subdiscipline | Impact (±EU28) | Co-publications | Output |
|---|---|---|---|
| Materials Science: **Surfaces, Coatings and Films** | 1.32 (0.02) | 20.3% | 5.61% |
| Materials Science: **Materials Chemistry** | 1.23 (-0.01) | 23.6% | 5.63% |
| Chemistry: **Organic Chemistry** | 1.05 (-0.15) | 16.0% | 8.77% |
| Chemistry: **Analytical Chemistry** | 0.98 (-0.15) | 17.9% | 6.73% |
| Chemistry: **Physical and Theoretical Chemistry** | 1.04 (-0.18) | 22.0% | 6.89% |
| Physics and Astronomy: **Atomic and Molecular Physics, and Optics** | 0.96 (-0.18) | 19.7% | 4.85% |
| Chemistry: **Inorganic Chemistry** | 0.92 (-0.18) | 28.1% | 8.15% |
| Engineering: **Mechanics of Materials** | 1.11 (-0.24) | 20.7% | 4.76% |
| Materials Science: **Polymers and Plastics** | 0.95 (-0.3) | 17.7% | 5.71% |
| Mathematics: **Applied Mathematics** | 1.0 (-0.33) | 27.2% | 3.1% |
| **Minor Subdiscipline** | **Impact (±EU28)** | **Co-publications** | **Output** |
| Arts and Humanities: **Music** | 4.46 (2.55) | 37.9% | 0.29% |
| Veterinary: **Small Animals** | 1.84 (0.8) | 42.9% | 0.79% |
| Arts and Humanities: **Visual Arts and Performing Arts** | 1.9 (0.58) | 20.0% | 0.22% |
| Physics and Astronomy: Acoustics and Ultrasonics | 1.66 (0.56) | 22.7% | 1.87% |
| Business, Management and Accounting: **Tourism, Leisure and Hospitality Management** | 2.14 (0.53) | 31.8% | 0.7% |
| Health Professions: **Podiatry** | 0.94 (0.36) | 12.8% | 5.43% |
| Nursing: **Gerontology** | 1.18 (0.34) | 20.0% | 0.73% |
| Nursing: **Advanced and Specialized Nursing** | 1.84 (0.33) | 51.3% | 0.57% |
| Nursing: **Psychiatric Mental Health** | 1.28 (0.32) | 46.9% | 0.54% |
| Materials Science: **Metals and Alloys** | 1.53 (0.31) | 23.7% | 4.22% |

Social Sciences and Humanities
Exact Sciences and Engineering
Life Sciences

Source: DG Research and Innovation, Dir. C – International Cooperation
Data: Elsevier SciVal; extraction date: 6/2/2016; publications' window: 2012-2014
Note: Categorisation according to Elsevier 'All Science Journal Classification'. Major (minor) subdisciplines are those with a publication share >0.3% (≤0.3%) among the publication output of the country. For each subdiscipline: (±EU28) shows the difference with the Impact for EU28. 'Co-publications' is the share of international publications and 'Output' is the share in the world's publications.

## Table 2: India - Top-10 technology shares of PCT patent applications.

| Technology | 2014 share (% change from 2010) | EU28 2014 share |
|---|---|---|
| **Organic fine chemistry** | 5.0% (1.0%) | 31.6% |
| **Pharmaceuticals** | 3.2% (0.1%) | 21.2% |
| **Biotechnology** | 1.2% (-0.1%) | 25.6% |
| **Micro-structural and nano-technology** | 1.2% (nan%) | 25.9% |
| **IT methods for management** | 1.2% (-0.1%) | 12.0% |
| **Chemical engineering** | 1.1% (0.5%) | 31.2% |
| **Macromolecular chemistry, polymers** | 1.0% (0.7%) | 26.0% |
| **Basic materials chemistry** | 0.9% (0.0%) | 26.4% |
| **Analysis of biological materials** | 0.7% (0.5%) | 29.9% |
| **Environmental technology** | 0.6% (-0.1%) | 31.6% |

Note: Statistics based on PCT applications published, by technology; total count by applicant's origin.
Source: DG Research and Innovation, Dir. C – International Cooperation
Data: WIPO, extraction date: 1/2/2016