Introduction

The idea for this co-publication map comes from a foresight study on the future of S&T cooperation between India and Europe that New INDIGO has been conducting (see **www.newindigo.eu/foresight**). When thinking about the future of cooperation, it is important to take current collaboration levels and patterns into account. An important indicator for this is joint scientific output in the form of co-publications.

In the context of its foresight exercise, New INDIGO engages in a dialogue with relevant stakeholders in EU-India S&T cooperation—concretely, the policy makers on both sides including the European Commission, programme managers, and scientists involved in the cooperation projects. With this in mind, the data presented here is not to be seen as a performance assessment or a concrete priority-setting recommendation; rather, the results are meant to inspire the joint development of visions for the future of EU-India S&T cooperation and discussions about how to bring them into reality. Therefore, we present this analysis as input for a stakeholder dialogue, where it will be qualitatively complemented and contextualised.

Methodology

The data basis for this study was collected from both of the current major citation databases: Scopus and Web of Science. Once retrieved, a series of iterative algorithms combined with random sampling controls ensured that the data stock was consistent and free from duplicates. The data was processed further, allowing for geodata and journal name disambiguation. Clear institution-record links and, as far as data quality allowed, author-institution links were established. With regard to the thematic classification, we used Scopus' set of journal subject categories (ASJC) and matched, as far as possible, Web of Science thematic categories with the ASJC classes in a semi-automatic procedure with the manual control of matches and partial category overlap.

All of the data analysed in this study changes continuously (journal coverage and citation counts). The data presented here is from August 2011.

Description of the different content sections

In addition to the visualisation on the front page of this co-publication map, you can find information about the level, growth, and thematic and geographic patterns of EU-India co-publications on this side. A first set of bar and line charts offers an overview of the level of and trends in EU-India co-publications as well as information about India's co-publication activity with other partners. Next, the thematic patterns in EU-India co-publications are visualised using different formats and subject area categorisation. Furthermore, we give some information about the trends in thematic patterns and the impact of Europe-India co-publications in different subject categories. Finally, the main subject categories in co-publications between India and individual EU27 + AC/CC countries are presented.

We chose to limit the text to an absolute minimum, using the space for more visualisations.

Number of Europe-India co-publications

Between 2000 and 2010, approximately 35,000 EU-India co-publications have been recorded in Scopus and Web of Science in total. Around 15 % are recorded in Web of Science only, and approximately 20 % in Scopus only.

The annual output of EU-India co-publications has developed as follows:

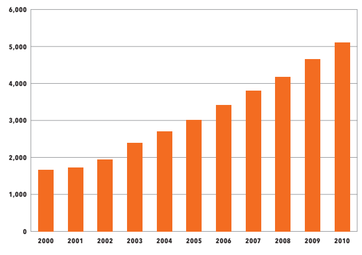


Figure 1: Number of co-published articles 2000–2010

New INDIGO Analyses

Mr. Florian Gruber, Mr. Alexander Degelsegger
Centre for Social Innovation
Linke Wienzeile 246
1150 Wien
Austria
Tel: +43 1 495 04 42 - 59
E-mail: gruber@zsi.at, degelsegger@zsi.at

New INDIGO Coordination

Ms. Aurélie Pachkoff
CNRS—International Relations Office
3 rue Michel-Ange
75794 Paris CEDEX 16
France
Tel: +33 1 44 96 42 39
Fax: +33 1 44 96 48 56
E-mail: aurelie.pachkoff@cnrs-dir.fr

www.newindigo.eu

New INDIGO is funded by the European Commission under the 7th Framework Programme

New INDIGO has succeeded in

- **building** a multilateral consortium of 28 European and Indian organisations centrally involved in science and technology (S&T) policy and funding
- **designing** and implementing **three calls for proposals** for EU-India S&T cooperation in the areas of biotechnology, health and water-related challenges
  - Networking Pilot Programme Call 1: networking projects in the fields of biomarkers and diagnostics, bioinformatics for health and structural biology for health
  - Networking Pilot Programme Call 2: networking projects in the fields of waste water management and green chemistry
  - Partnership Programme Call 1: research projects in the field of biotechnology applied to human health
- **supporting** the coordination of national S&T policies by offering analytical evidence and leading a foresight process on EU-India cooperation in 2020
- **facilitating** access to the European Research Area by promoting FP7 in India's scientific community and creating a local support system, the Indian Focal Points
- **allowing for synergies** by linking up with related supporting projects targeting India as well as with thematic ERA-NETs
- **showcasing and increasing** S&T cooperation between India and the EU, among other things by organising EU-India S&T Cooperation Days
- **fostering** cooperation by providing an online portal that offers not only valuable information about S&T in both regions, but also communication tools for actual collaboration

New INDIGO consortium

Operational partners

National Centre for Scientific Research (CNRS), France **(Coord.)**
Council of Scientific and Industrial Research (CSIR), India **(Co-coord.)**
Association of Electronics and Information Technology Industries of the Basque Country (GAIA), Spain
Centre for Social Innovation (ZSI), Austria
Department of Biotechnology (DBT), India
Foundation for Science and Technology (FCT), Portugal
International Bureau of the Federal Ministry of Education and Research at the German Aerospace Center (IB-DLR), Germany
Netherlands Organisation for Scientific Research (NWO), Netherlands
Scientific and Technological Research Council of Turkey (TÜBITAK), Turkey

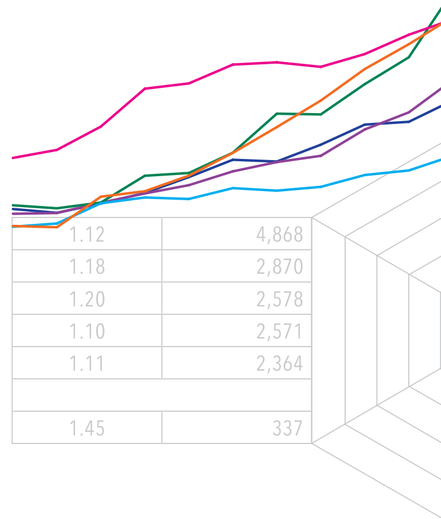
Steering Committee members

Department of Science and Technology (DST), India
Federal Ministry of Education and Research (BMBF), Germany
Federal Ministry of Science and Research (BMWF), Austria
Ministry of Foreign and European Affairs (MAEE), France
Ministry of Higher Education and Research (MESR), France
National Innovation Office (NIH), Hungary

Observers

Academy of Finland (AKA), Finland
Danish Agency for Science, Technology and Innovation (DASTI), Denmark
German Research Foundation (DFG), Germany
Indian Council of Medical Research (ICMR), India
Indian Institute of Science (IISc), India
Ministry of Science and Innovation (MICINN), Spain
National Institute for Agricultural Research (INRA), France
National Institute of Health and Medical Research (INSERM), France
Research Council of Norway (RCN), Norway
Research Councils UK (RCUK), UK
Research Foundation—Flanders (FWO), Belgium
Royal Netherlands Academy of Arts and Sciences (KNAW), Netherlands
Royal Society (RS), UK

CO-PUBLICATION MAP



Science brings Europe and India closer

India and major partner regions

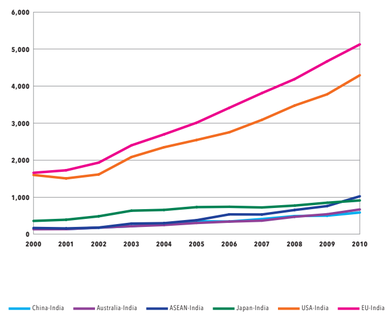


Figure 2: Number of co-published articles per year

India and countries in its relative proximity

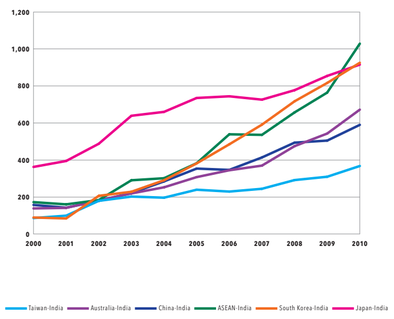


Figure 3: Number of co-published articles per year

EU-India

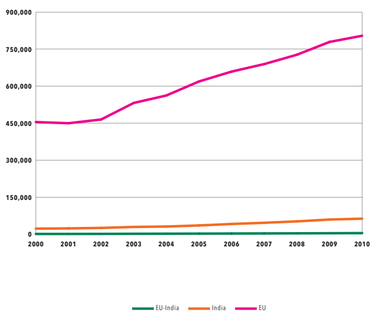


Figure 4: Number of publications and co-publications

EU-India

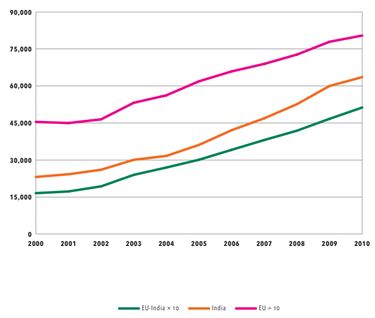


Figure 5: Number of publications and co-publications *(normalised view)*

EU-India

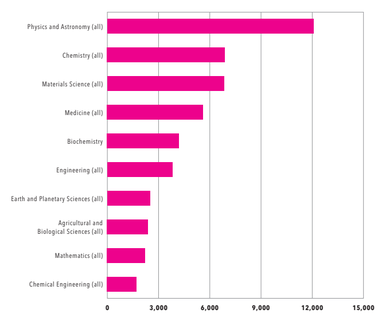


Figure 6: Number of co-publications in selected ASJC clusters

This word cloud gives a visual impression of the most important keywords in EU-India co-publications, as specified by the journal publishers. We selected a limited number of the most frequent keywords and eliminated generic keywords.

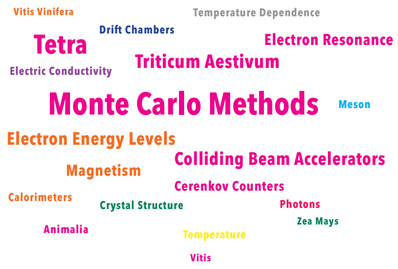


Figure 7: Most important journal keywords

Definitions and abbreviations

ASJC All Science Journal Classification; this is a list of around 300 journal subject categories Elsevier assigns to the journals indexed in Scopus. One or multiple ASJCs can be assigned to each journal. Articles published in a specific journal get assigned the same ASJCs as the journal they appear in.

Categories and clusters As mentioned above, the citation databases make use of journal subject categories to structure the dataset. We also use these journal subject categories and distinguish between two levels: the more fine-grained level of the ASJCs is referred to as 'category', while 'cluster' refers to a thematic set of categories. A cluster can, however, also be assigned to a journal directly as a category.

Co-publication A publication, indexed in one of the major citation databases we use (Scopus and Web of Science), written by at least two authors based in at least two different countries.

EU27 + AC/CC These abbreviations refer to the 27 Member States of the European Union plus the candidate countries (Croatia, Turkey, Montenegro, FYRO Macedonia) and the countries associated to FP7 (in addition to the candidate countries, most notably Switzerland, Israel, Norway, Iceland, Liechtenstein, as well as western Balkan countries). If not stated otherwise, 'EU' refers to the EU27 + AC/CC in this publication.

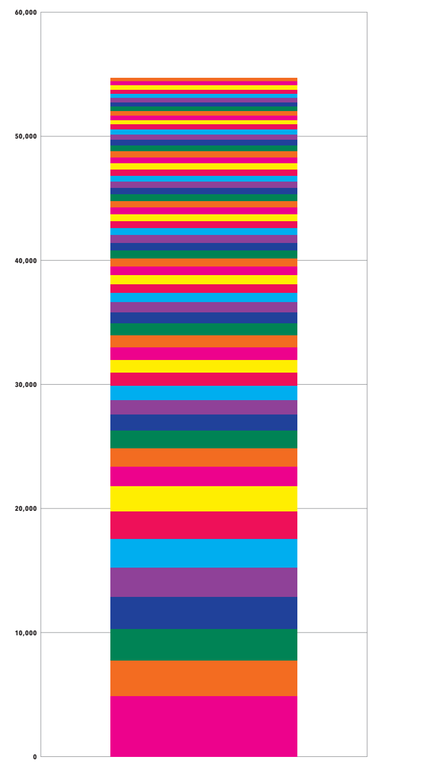
FP7 Seventh Framework Programme for Research and Technological Development of the European Union (2007–2013); will be succeeded by Horizon 2020.

SFIC Strategic Forum for International Cooperation; a strategic international S&T policy-making body bringing the European Commission together with interested EU Member States.

SFIC IPI The India Pilot Initiative of SFIC; India was selected as the first country SFIC focused its activities on.

S&T Science and technology.

EU-India



319	Pediatrics, Perinatology, and Child Health	6,34
327	Applied Microbiology and Biotechnology	13,67
330	Water Science and Technology	6,81
337	Artificial Intelligence	2,7
339	Biochemistry, Genetics and Molecular Biology (all)	8,53
339	Oncology	16,66
344	Geochemistry and Petrology	10,49
357	Computer Science (all)	3,26
359	Microbiology	12,55
361	Industrial and Manufacturing Engineering	6,06
369	Spectroscopy	5,95
377	Engineering (all)	6,19
413	Geology	9,28
451	Mathematics (all)	3,14
456	Public Health, Environmental and Occupational Health	10,27
474	Drug Discovery	9,42
482	Cell Biology	13,09
486	General	22,88
486	Statistics and Probability	5,77
493	Ceramics and Composites	11,12
499	Physics and Astronomy (miscellaneous)	11,81
506	Mathematical Physics	8,2
517	Analytical Chemistry	7,43
520	Polymers and Plastics	11
526	Catalysis	16,29
547	Ecology, Evolution, Behavior and Systematics	8,08
563	Statistical and Nonlinear Physics	6,19
566	Instrumentation	12,99
573	Biotechnology	11,88
615	Applied Mathematics	3,91
617	Agronomy and Crop Science	10
628	Pharmacology	8,4
666	Chemical Engineering (all)	9,03
701	Plant Science	10,56
705	Computer Science Applications	5,53
710	Metals and Alloys	7,96
750	Infectious Diseases	11,73
822	Surfaces, Coatings and Films	10,92
907	Genetics	13,96
935	Molecular Biology	12,95
974	Medicine (all)	17,86
996	Mechanics of Materials	5,91
1015	Mechanical Engineering	6,48
1096	Space and Planetary Science	12,92
1139	Astronomy and Astrophysics	12,72
1140	Atomic and Molecular Physics, and Optics	6,18
1336	Organic Chemistry	9,77
1403	Electrical and Electronic Engineering	6,3
1495	Biochemistry	10,26
1582	Inorganic Chemistry	10,26
2020	Electronic, Optical and Magnetic Materials	7,55
2245	Nuclear and High Energy Physics	18,94
2281	Physical and Theoretical Chemistry	10,54
2364	Materials Chemistry	9,76
2571	Physics and Astronomy (all)	15,08
2578	Materials Science (all)	5,73
2870	Chemistry (all)	8,88
4868	Condensed Matter Physics	6,2

Number of co-publications, ASJC, average times each article in ASJC is cited

Figure 8: Prominent thematic categories (ASJCs) in co-publications 2000–2010

Growth in thematic areas

After this overview of the relevance of different thematic categories and clusters in EU-India co-publications, we now invite you to look into the growth in co-publications in the respective thematic areas. As can be seen in the table below, the growth rates in the numbers of co-publications in certain topic areas vary considerably over the period under review.

High increases do not necessarily mean that co-operation has recently been producing more output; they can also indicate areas that were not covered by the databases before.

Table 1: Average annual growth rates of major ASJCs, EU-India 2000–2010

ASJC	Growth rate	Co-publications
Condensed Matter Physics	1.12	4,868
Chemistry (all)	1.18	2,870
Materials Science (all)	1.2	2,578
Physics and Astronomy (all)	1.1	2,571
Materials Chemistry	1.11	2,364
Selected ASJCs with particularly high growth rates		
Artificial Intelligence	1.45	337
Surgery	1.42	243
Agricultural and Biological Sciences (all)	1.41	213
Pharmacology (medical)	1.39	250
Toxicology	1.36	223

Impact

In figure 8, we have also included data on the impact of co-publications in different thematic areas. For each ASJC in the legend of figure 8, we specify the average number of times that EU-India co-published articles have been cited (as of August 2011).

Citation culture varies considerably between disciplines, so comparisons of average citation counts between the thematic areas are of limited value. However, comparing these figures with the average citation rate in all publications in the area of interest (which we are not able to collect and present in this context) can indicate whether co-publications have a higher impact and to what extent. Academic literature claims that higher impact values can be expected to a certain extent given that more authors in more networks will always lead to more citations (which can still be seen as a higher impact).

Thematic patterns in country-country co-publication links

Finally, we extend the analysis of thematic patterns in EU-India co-publications to the level of country-country relations. This can help multilateral dialogue and future priority setting to take into account present strengths that can be built upon. The information can also indicate starting points for stepping up bilateral cooperation in certain areas of interest. Strong bilateral ties can be moved up to a regional level or can clarify what exactly is needed in a specific thematic area for cooperation to function.

The following set of radial charts gives this more detailed account of the thematic focus of co-publications between India and individual European countries. The six most important ASJCs in joint scientific output are shown, including the respective number of co-publications between the years 2000 and 2010. In the case of most countries, the dominance of the broader field of physics in EU-Indian co-publications is also evident at this more detailed level of analysis.

For an understanding of the transformation of thematic collaboration patterns over time, the number of co-publications in these fields was compared in two five-year timeframes. We can derive from this data that in some areas, co-publication activity with India only started after 2005, and that priorities have shifted in others.

In terms of trends over time, those cases seem most interesting where one or both of the curves for 2001–2005 and 2006–2010 deviate from the 2000–2010 baseline in their course, though naturally at a lower level.

It should be noted that for co-publication counts lower than 50 per country or per thematic area, results (particularly the precise ranking of thematic areas or trends over time) are indicative rather than reliable.

The European countries represented are those that are part of the New INDIGO project consortium and/or that have been involved in the SFIC IPI group. The radial charts are aligned by following their geographical position and neighbours.

Denmark-India

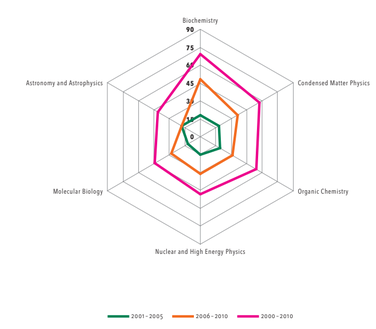


Figure 9: Six most important thematic categories (ASJCs)

Norway-India

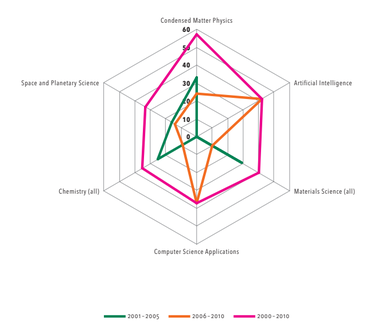


Figure 11: Six most important thematic categories (ASJCs)

Finland-India

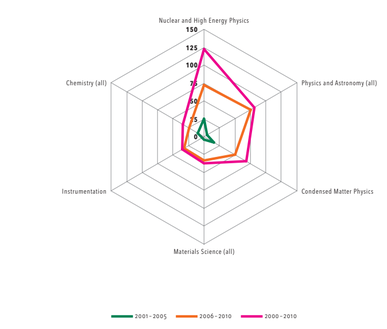


Figure 13: Six most important thematic categories (ASJCs)

Below, thematic patterns in co-publications of selected non-EU member countries with India are depicted. The selected countries are all associated to FP7, which means that they have chosen to contribute financially to the programme and participate with the same rights and obligations as EU Member States. They also participate in policy-making processes regarding the Framework Programmes.

These countries are currently associated to FP7: Albania, Bosnia and Herzegovina, Croatia, Faroe Islands, the Former Yugoslav Republic of Macedonia, Iceland, Israel, Liechtenstein, Montenegro, Norway, Republic of Moldova, Serbia, Switzerland and Turkey.

Netherlands-India

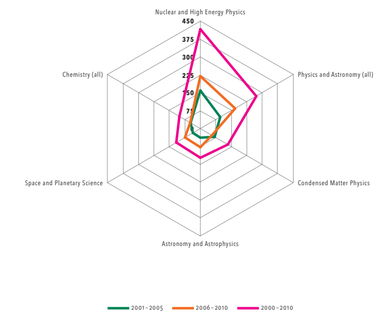


Figure 10: Six most important thematic categories (ASJCs)

Sweden-India

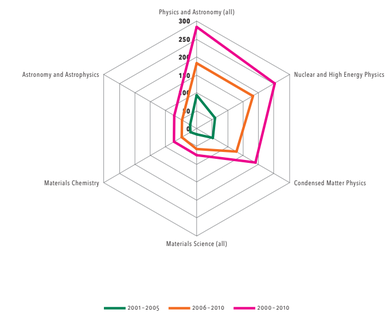


Figure 12: Six most important thematic categories (ASJCs)

Estonia-India

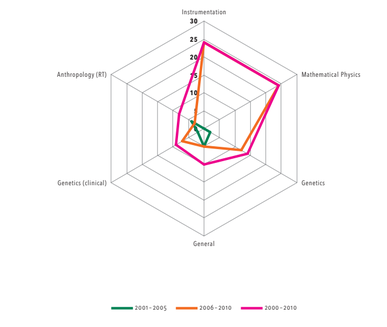


Figure 14: Six most important thematic categories (ASJCs)

Switzerland-India

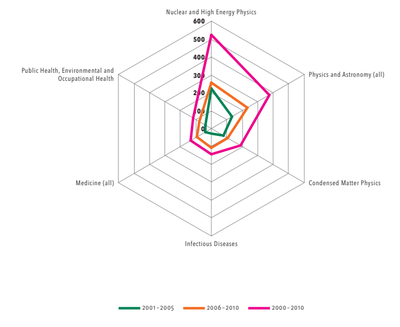


Figure 15: Six most important thematic categories (ASJCs)

Portugal-India

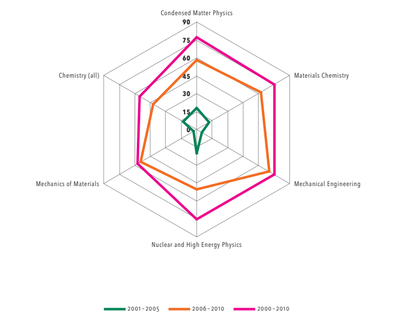


Figure 16: Six most important thematic categories (ASJCs)

Ireland-India

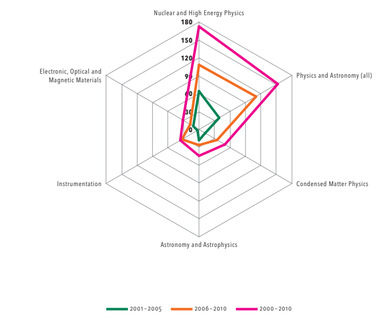


Figure 18: Six most important thematic categories (ASJCs)

Belgium-India

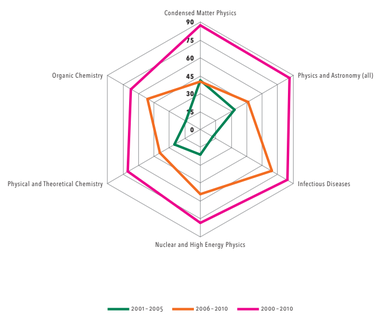


Figure 20: Six most important thematic categories (ASJCs)

Germany-India

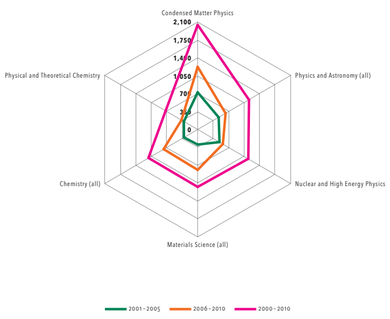


Figure 22: Six most important thematic categories (ASJCs)

Hungary-India

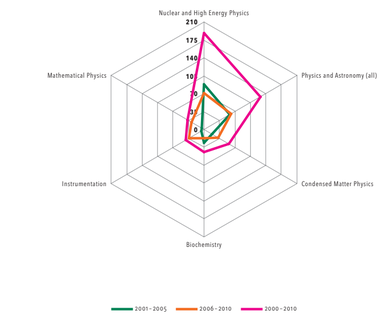


Figure 24: Six most important thematic categories (ASJCs)

Turkey-India

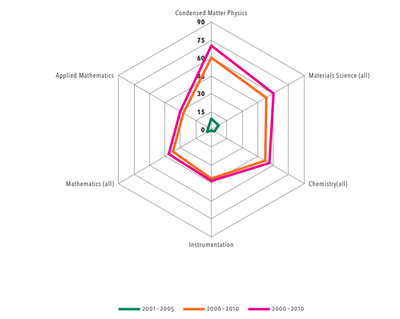


Figure 26: Six most important thematic categories (ASJCs)

Spain-India

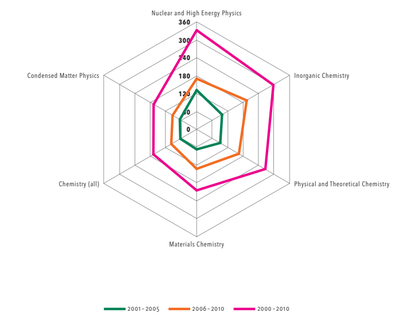


Figure 17: Six most important thematic categories (ASJCs)

UK-India

Figure 19: Six most important thematic categories (ASJCs)

France-India

Figure 21: Six most important thematic categories (ASJCs)

Austria-India

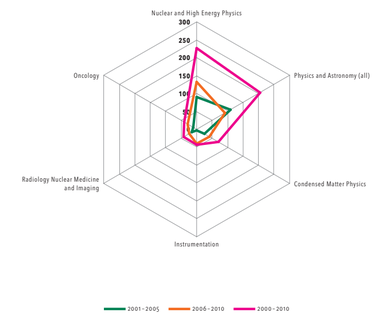


Figure 23: Six most important thematic categories (ASJCs)

Italy-India

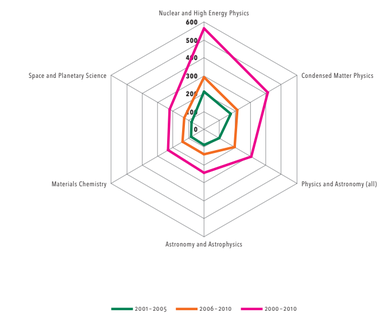


Figure 25: Six most important thematic categories (ASJCs)

Israel-India

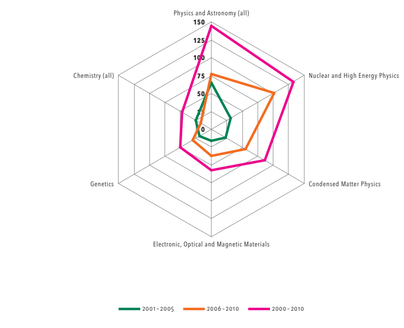


Figure 27: Six most important thematic categories (ASJCs)

Science brings Europe and India closer

New INDIGO

34,645 co-publications

28 European and Indian Partner Organisations Focusing on Achieving One Objective – to Create Coherent Synergy in Europe's Partnership with India in Science, Research & Technology.

What is New INDIGO?

New INDIGO is a consortium of European and Indian S&T organisations involved in promoting research cooperation between Europe and India. It is intended to strengthen the international dimension of the European Research Area (ERA) by providing a networking platform for Indian and European S&T organisations.

www.newindigo.eu

Design: H. Gödl – jflowmap by Ilya Boyandin, http://code.google.com/p/jflowmap/