



## Initiative for the Development and Integration of Indian and European Research

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**New INDIGO International S&T Cooperation Foresight:  
A study of S&T cooperation future(s) between Europe and India - Vienna, May 2012**

Project Deliverable 4.5



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## Table of Contents

New INDIGO International S&T Cooperation Foresight: .....	2
A study of S&T cooperation future(s) between Europe and India.....	2
Project Deliverable 4.5 .....	2
Executive Summary .....	3
1. Introduction .....	5
2. The Methodology – a success scenario foresight based Cooperation Foresight exercise.....	6
A success scenario based foresight process .....	7
3. Desk research input: international co-publications .....	10
Collaboration Dynamics – Results of the Co-Publication Study .....	11
4. Identification of drivers of future S&T cooperation .....	16
5. Success scenario generation .....	25
Success Scenario “Facilitating – Funding – Training” .....	26
Success Scenario “Focusing within Diversity” .....	27
Success Scenario “Complementarity and Mutual Strengths” .....	28
6. Scenario validation .....	29
7. The consolidated success scenario – long term recommendations .....	31
8. Selective backcasting – Vienna Foresight workshops .....	35
9. Short-term recommendations .....	36
Literature .....	38
Annex .....	39



## Executive Summary

As one of the BRICS countries, India is among the biggest and most dynamic emerging economies worldwide, which increasingly excel in the area of science and technology (S&T). The European Commission and the European countries perceive India as an important future partner when it comes to S&T, as is evidenced by the fact that India was chosen to be the target country of the first pilot initiative of the Strategic Forum for International Science and Technology Cooperation (SFIC).

The EC funded project New INDIGO, which specifically targets S&T cooperation with India, was tasked to conduct a one-year long foresight study on the future of this cooperation between India and Europe. The consortium agreed to envisage a 2020 perspective, in line with the Europe 2020 strategy and the Decade of Innovation announced by the President of India in 2009.

Besides the year **2020 scenario** of successful S&T cooperation (see chapter 8) between Europe and India, the major outcomes of the foresight exercise have been **long and mid-term recommendations and more immediate policy recommendations for concrete action**:

### Long- and mid-term S&T policy recommendations in brief:

- acknowledge and capitalise on the role of established multidisciplinary networks
- allow for brain circulation, removing barriers for mobility and facilitating career development
- ensure common standards
- allow for financial resources (public and, increasingly, philanthropic): especially top-up funds for mobility
- enable access to joint and national infrastructure
- offer a single entry point for information
- involve business communities
- establish formal joint PhD programmes

### Short term S&T policy recommendations in brief:

Extended programme context

- longer-term multiple-entry visas
- avoid necessity for multiple approvals for project related visits
- methods and standards jointly published
- common set of rules for shipment/exchange of samples

Science-industry linkages

- common standards in patenting
- exchange of professionals from industry and public and inclusion of students in applied private R&D
- projects at the interface of pure and applied science

Mode for selecting thematic priorities for cooperation

- mixed scientist-policy maker working groups
- mapping of clusters and research hotspots
- open platforms for information sharing

#### Call publishing, funding modes & reporting/monitoring

- combination of real and virtual common pot funding with regular multilateral calls
- bi-regional monitoring and reporting and optimised evaluation procedures
- short time lag between proposal submission and start of projects

#### Network Setup

- address brain circulation
- mutuality in exchange and analysis of biomaterials
- programmes of longer duration
- increased use of virtual conferences and e-learning infrastructure
- adequate guest houses

#### Higher education issues

- cross-regional interaction, e.g. between clinicians and between clinicians and basic scientists
- joint supervision of PhDs
- short-term internship training programmes
- support to Master-level students doing lab internships with scientists in the other region

These recommendations have been developed and validated in an interactive process involving more than 1.000 stakeholders from policy making, programme administration and science.

## 1. Introduction

Cooperation between India and Europe in the area of science and technology has been growing for a long time and at an increased pace, recently: Researchers from both regions work together in a higher number of projects funded by national and an increasing amount of bilateral programmes as well as by the European Framework Programme 7.

However, the quantity and depth of cooperation can be further strengthened – cooperation has not reached its potential, particularly when taking into account the rapidly rising public and, to a lesser extent (until now), private R&D spending in India.

While detailed figures about the increasing number of co-patents induced by joint research are not available yet, the analysis of co-publication implemented by New INDIGO gives quite detailed insights into scope and dimension of EU-India scientific cooperation.<sup>1</sup>

New INDIGO has been created to increase multilateral cooperation within and outside of the Framework Programme. As knowing how and in what areas cooperation should take place is crucial for enhancing cooperation effectively, the analysis of the status quo and an assessment of future scenarios is needed.

This means that framework conditions have to be taken into account, cooperation formats designed, topics prioritised, suitable support instruments identified and barriers removed, which are hindering research cooperation. To contribute to these objectives, the New INDIGO project's analysis team implemented a scenario-based cooperation foresight study “to open up and structure the discussion on the potential future cooperation(s) between the EU and India” in the field of S&T. This exercise has been running from November 2010 until spring 2012 and has involved and engaged a large number of different stakeholders.

With this project deliverable, we present the most important results; however we have also the following **fringe benefits of this foresight exercise**:

- a large number of **scientists** has been engaged in thinking about the future of S&T cooperation between India and Europe, its purpose, idea setup, etc. It has been crucial to reach out to this group as the scientists are the ones actually engaged in cooperation.
- the key S&T **policy makers** from two of the, in S&T matters, most relevant Ministries in India (Department of Science & Technology, Department of Biotechnology) as well as their colleagues in Science Ministries from major European countries have been involved in a thinking and joint vision building process. It has been crucial to involve this group of people as they are the ones supporting and designing the framework conditions of future cooperation.
- European and Indian **programme-owners and science administrators** have been engaged in the process.
- The number, most relevant fields and impact of **scientific co-publications** jointly produced by Indian and European researchers have been mapped and analysed.

**Long-term recommendations** for improving bi-regional S&T cooperation between India and Europe have been identified and are presented (and publicly available) in the format of a 2020 success scenario.

Departing from the 2020 success scenario and taking the example of multilateral initiatives like the New INDIGO ERA-Net as an example, **policy recommendations for more**

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<sup>1</sup> See Annex

**immediate action** have been extracted and fed into the policy-making process (concretely, the development of a **Joint Strategic Agenda for Europe-India S&T cooperation**).

The following chapters summarise the results of the foresight exercise. Before moving to its outputs, however, we will present the study's underlying methodology.

## 2. The Methodology – a success scenario foresight based Cooperation Foresight exercise<sup>2</sup>

Main methodologies used:

- Delphi analysis
- Scenario Building
- Expert Workshops
- Bibliometric Analysis

In her address to Parliament on 4th June 2009, the president of India declared the year from 2010 to 2020 as the „Decade of Innovation“. The main aim of the declaration is to develop an innovation eco-system to stimulate innovations and to produce solutions for the societal needs in terms of healthcare, energy, urban infrastructure, water and transportation. Although the gamut of innovation is vast and includes efforts in many sectors, the underlying emphasis to boost advances in Science and Technology. At more or less the same time, the European Union introduced the „Innovation Union“, a flagship programme to be implemented from 2014 to 2020 to secure Europe's competitiveness and face major societal challenges on a global level.

The similarity of the political initiatives in both regions were the background against which a „success scenario foresight“ study was conducted: a desirable scenario of how S&T cooperation should look like in 2020 was developed and respective instruments that help to get there were identified.

At the basis of the study design and methodology is the thought that three main stakeholder groups are relevant when thinking about the future of EU-India S&T cooperation (there are more, but we considered these three the maximum number of stakeholders that we could involve given the mandate and the limited resources at hand):

- policy makers
- programme owners
- scientists

The policy-makers design the framework conditions within which S&T cooperation takes place and decide upon support structures. The programme owners/managers adopt an intermediary position between policy-makers and scientists. They know both worlds, co-develop and implement dedicated programmes and, thus, are engaged in the actual implementation of S&T internationalisation policies. The scientists, finally, are the ones actually performing research cooperation. They are the ultimate target group and main beneficiary of all internationalisation policies.

In order to gather data and opinions all three of these groups as well as to include and engage them in the process of thinking about the future S&T cooperation between the two regions,

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<sup>2</sup> The authors would like to thank Michael Keenan, currently at the OECD in Paris and formerly at the Manchester Institute of Innovation Research, for his methodological advice for this foresight exercise. His experience and knowledge of the field have been extremely helpful in designing this exercise.



we decided to approach the stakeholder groups in different ways: in the case of policy-makers and programme owners by means of physical workshops in the framework of the New INDIGO project and beyond, in the other case via an online Delphi survey with a preceding open email consultation.

The main reason behind these different ways of approaching the stakeholder groups is the fact that policy-makers and programme owners concretely concerned with (and thus knowledgeable about) this form of cooperation are few in number. These few, however, seemed to have a good overview on the current state of programmes and on the future plans, according to our preparatory analyses and project experience. Thus, it makes sense to try to investigate their expertise in more depth and engage them personally, not least because they have a major stake in designing the political framework conditions for the future they are reflecting upon with us in the foresight analysis.

As regards the programme makers, again, their number is limited, and several of them who are engaged in EU-India cooperation in their national contexts also act as policy makers (especially in the smaller EU Member States and in India). It was this group of stakeholders that was most readily accessible via the New INDIGO project as they formed part of the consortium as partners or Steering Committee members.

The scientists, however, are a much larger stakeholder group. We decided to not randomly approach large groups of Indian or European scientists, nor to invite small groups to give us their individual and, given the large size of the population, unrepresentative views. Instead, we considered it most reasonable to approach those scientists who already have cooperated. We decided to revert to co-publications as a proxy for cooperation experience, i.e. we looked for scientists from each of the regions who have already published with scientists from the respective other region, and engaged them via an online consultation and Delphi survey.

The whole exercise has been dealing with the constraints proper to International S&T Cooperation Foresight<sup>3</sup> exercises: increased complexity due to the bi-regional perspective with, at the same time, very limited time resources of and difficult access to policy-making stakeholders. Moreover, members of this stakeholder group are, as said above, in positions not only to assess, but to significantly shape the future we aim to look at, which again adds complexity to the process as few relevant variables can be considered totally external. Regarding the scientific community, it is not easy (due to time constraints on their side, negative experiences with policy consultation processes or simply disinterest) to attract those scientists to the foresight exercise, who are good, actually cooperating and, at the same time, knowledgeable about science cooperation (and willing to adopt a meta-perspective on what they are doing).

### ***A success scenario based foresight process***

Over the years, social scientists and policy-makers have used several methodologies to gain insights into the future and develop action-orienting conclusions according to a desired one. When it comes to international S&T cooperation policy, however, the approach of scenario

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<sup>3</sup> Foresight has recently emerged in several EC funded projects as an important tool in structuring the thinking and discussion about future S&T cooperation and related activities. Due to several methodological issues that set this kind of foresight apart from, for instance, national technology foresight exercises (see reflections in our methodological chapter) the authors of this report decided to coin this new appellation „International S&T Cooperation Foresight“.

building based foresight has shown to be popular<sup>4</sup>. An exemplary effort in this direction can be seen in the SCOPE2015 foresight project conducted for the INCO<sup>5</sup> directorate of the European Commission's Research Directorate General by PREST/Manchester<sup>6</sup>. Currently, several INCO projects<sup>7</sup> or, for example, the International Council for Science (ICSU)<sup>8</sup> are using scenario techniques for S&T cooperation relevant foresight exercises.

It is not surprising that in the pre-foresight phase of this exercise, desk research and consultations with project partners have equally shown that scenario techniques seem most appropriate for the data generating, networking and strategy development<sup>9</sup> part of the foresight process. It became also clear, however, that S&T cooperation foresight has characteristics and needs that are different from national technology foresight or scenario planning in corporate strategic thinking.

Scenarios are built up from collective visions of the future by a group of experts and should help decision-makers and other stakeholder groups to simplify "the avalanche of data into a limited number of possible states"<sup>10</sup>. Scenario building efforts often start with the clarification of the setting, the identification and analysis of driving forces ('drivers') that are considered to influence how the present will be transformed in the future in specific areas of interest, and a subsequent importance ranking of the identified drivers as well as of uncertainties that become apparent during the process. Then, the scenario logics are defined, scenarios fleshed out and their implications discussed<sup>11</sup>. Thus, generic scenario building exercises comprise an exploratory elaboration of several futures that range from desired developments to undesired futures that are better avoided.

In addition to exploratory scenario building processes resulting in multiple scenarios, another approach is outlined in literature, namely the "success scenario" method<sup>12</sup>. Therein, an effort is made to present an image of a desirable condition in form of one single scenario in order to help decision-makers reflect the current situation and identify crucial steps in view of a favourable future. A related scenario building exercise can then be used by decision makers to streamline their approach to the topic in question. As Vincent-Lancrin has put it: "*Future scenarios do not aim to predict the future [...] but merely aim to provide stakeholders with tools for thinking strategically about the uncertain future before them, which will be partly shaped by their actions and partly by factors beyond their control*"<sup>13</sup>. This "singular scenario" approach is also useful when it comes to structuring and guiding discussions so that underlying assumptions become clear and can be explicated<sup>14</sup>. Moreover, from our perspective and mandate we could expect that, by assigning importance to cooperation between specific regions, the consulted stakeholders from both sides, when answering our requests and offering their views and strategic thinking on a successful region-to-region S&T

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<sup>4</sup> Scenario techniques are also used in thematically much broader foresight exercises as the European Commission (2009) report "The World in 2025. Rising Asia and Socio-Ecological Transition" shows

<sup>5</sup> International Cooperation

<sup>6</sup> For the final report see: European Commission (2006): Scenarios for future scientific and technological developments in developing countries 2005-2015, EC DG Research: Brussels

<sup>7</sup> Next to New INDIGO: SEA-EU-NET with Southeast Asia and ERA-Net RUS with Russia

<sup>8</sup> ICSU Foresight Analysis on the potential development of international science, online at:

[http://www.icsu.org/1\\_icsuinscience/PDF/ICSU\\_Foresight\\_summary.pdf](http://www.icsu.org/1_icsuinscience/PDF/ICSU_Foresight_summary.pdf), most recent access date: 3 March 2010

<sup>9</sup> Van der Meulen, Barend (2007): Looking Beyond the Endless Frontier. ESF Forward Looks Scheme: Analysis and Recommendations, European Science Foundation: Strasbourg, 10.

<sup>10</sup> Schoemaker, Paul J.H. (1995): Scenario Planning: A Tool for Strategic Thinking, in: Sloan Management Review, 36(2), p. 27.

<sup>11</sup> IPTS/Joint Research Centre of the European Commission (2007): Online Foresight Guide. Scenario Building, online at: [http://forlearn.jrc.ec.europa.eu/guide/3\\_scoping/meth\\_scenario.htm](http://forlearn.jrc.ec.europa.eu/guide/3_scoping/meth_scenario.htm), most recent access date: 3 March 2010

<sup>12</sup> Miles, Ian (2005): Scenario Planning, in: UNIDO Technology Foresight Manual. Volume 1 – Organization and Methods, 168-193

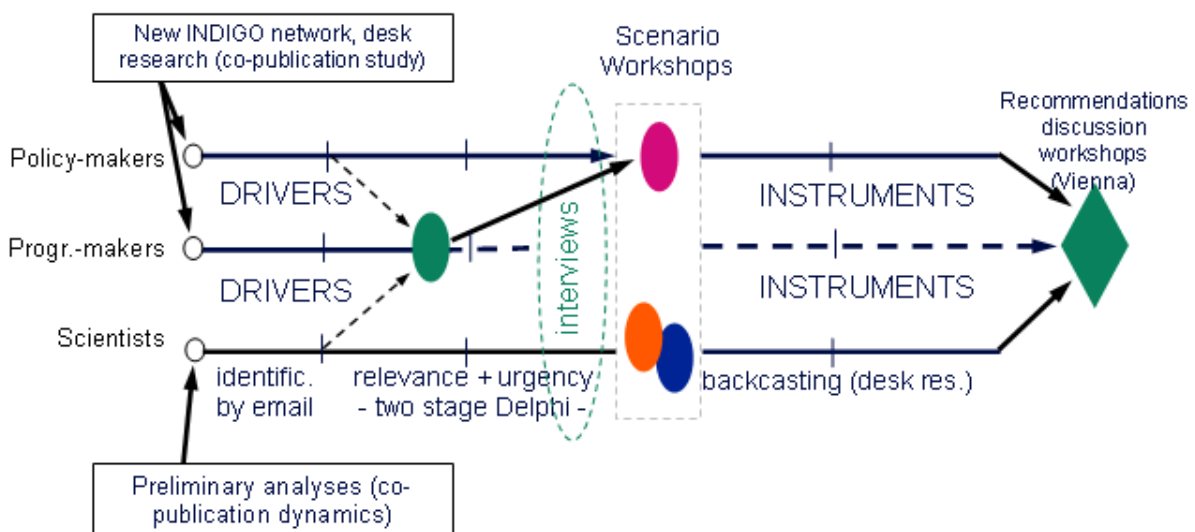
<sup>13</sup> Vincent-Lancrin, Stéphan (2009): What is Changing in Academic Research? Trends and Prospects, in: OECD (ed.): Higher Education to 2030. Volume 2. Globalisation, OECD: Paris, p. 173.

<sup>14</sup> Miles, Ian / Green, Lawrence / Popper, Rafael (2004): FISTERA WP4 Futures Forum. D4.2 Scenario Methodology for Foresight in the European Research Area, European Communities: Brussels

cooperation, would be induced to at least think about and maybe give importance to this specific kind of cooperation.

The New INDIGO Foresight exercise has started at the beginning of 2011 with preliminary desk analyses on drivers of S&T cooperation and with the analysis of EU-India co-publication trends. On this basis, we can provide evidence on the current status of S&T cooperation between India and Europe as an input to the foresight and wider policy processes. Furthermore, in a series of online consultations as well as expert workshops, factors (‘drivers’) have been identified that are likely to influence what this future might look like in the year 2020. Figure 1 describes our procedural method that can roughly be divided into two phases: one before and one after the first draft of a success scenario. The first spans from the preparatory analyses via the driver identification by literature analysis, email consultations, expert workshops and an online Delphi survey to the scenario workshops leading to a draft success scenario. The second involves consultations on the validity and viability of the success scenario for different stakeholder groups, backcasting activities trying to indicate paths towards the success scenario as well as the development of instrument and policy recommendations.

Here is a flowchart of the original methodological design of the exercise:



**Figure 1: New INDIGO Foresight Exercise Methodology 2011**

Foresight is an interactive and dynamic process also with regard to the methodology used. It is recommended to continuously revise and adapt it along the process in order to meet new needs, tap into resources previously unknown or take into account new developments. Resources issues also sometimes require a modification of the process design. Here is a similar flowchart representing the actually implemented methodology.

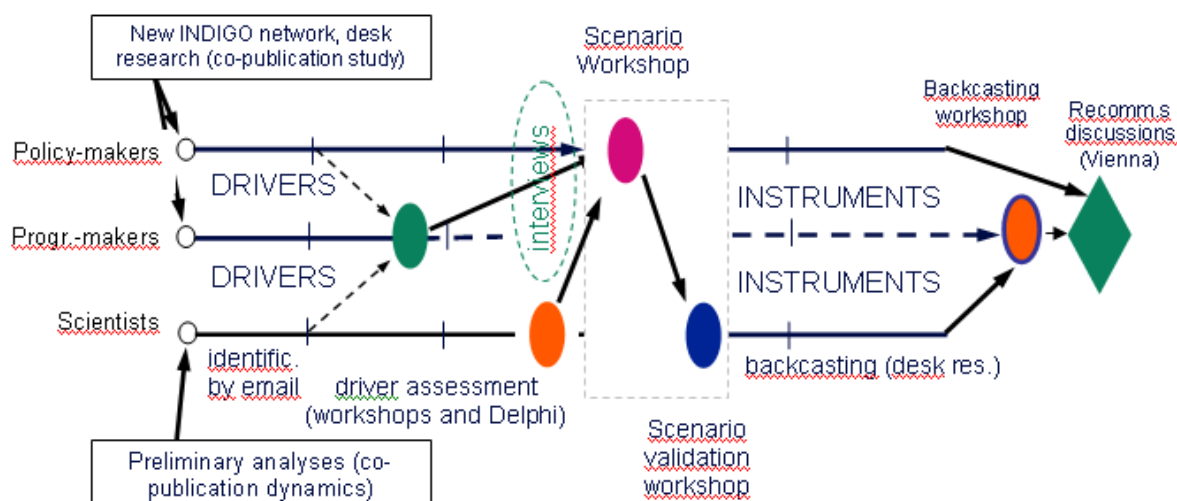


Figure 2: New INDIGO Foresight Exercise as carried out

We will now present the findings of our analysis of India-EU co-publications (Letters ‘A’ in Figure 1) prepared as reference material for the qualitative discussions with stakeholders and S&T cooperation policy making in general. Subsequently, we delve into the results of the Foresight exercise itself and its diverse activities. Finally, we will present the long-term scenario as well as more short-term policy recommendations and give a brief outlook on possible further steps and usage of the foresight results.

### 3. Desk research input: international co-publications

At the Centre for Social Innovation (ZSI), the New INDIGO project has identified scientists with international cooperation experience with the help of a bibliometric analysis of co-publications. This analysis offers many insights in addition to being a starting point for the New INDIGO Foresight, for instance as an orientation for priority settings.

The concept of **international co-publication** is defined as a publication (academic article, proceedings paper, or letter) with 2 or more authors affiliated to institutions from 2 or more different countries. The number of these international co-publications has significantly risen at a steeper pace than overall publications. These figures give us an idea of how collaboration as a whole is changing in number and quality.

The source of our data is a diligent consolidation of the data from two major scientific literature and citation databases (online), namely Elsevier SCOPUS<sup>15</sup> and ISI<sup>16</sup> Web of Science. We aimed to offer insights from a stock of literature as complete as possible, but naturally both databases still have limitations, for instance regarding the coverage of non-English journal publications. However, with regard to India this might be less of a problem, especially as most international co-publications are produced and published in English anyway.

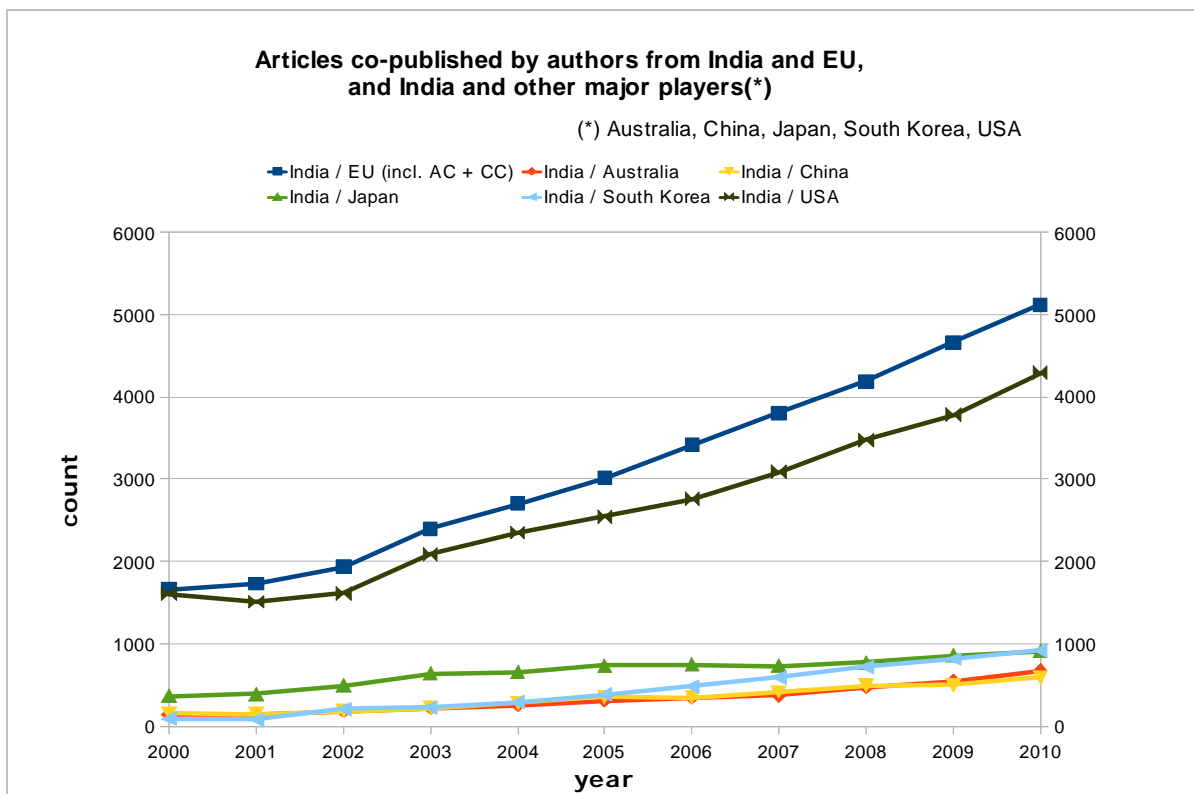
<sup>15</sup> <http://www.info.sciverse.com/scopus/>

<sup>16</sup> Institute for Scientific Information - was acquired by the Thomson Reuters Corporation in 1992; <http://www.isiwebofknowledge.com/>

We observed a period between 2000 and 2010 and retrieved 51 825 EU-India co-publications. This number is composed of 34 768 publications that are recorded in both databases, 7 059 only traced by Web of Science and 9 998 that could only be found in SCOPUS. With the data retrieved we ran several analyses and fabricated various types of visualisations.

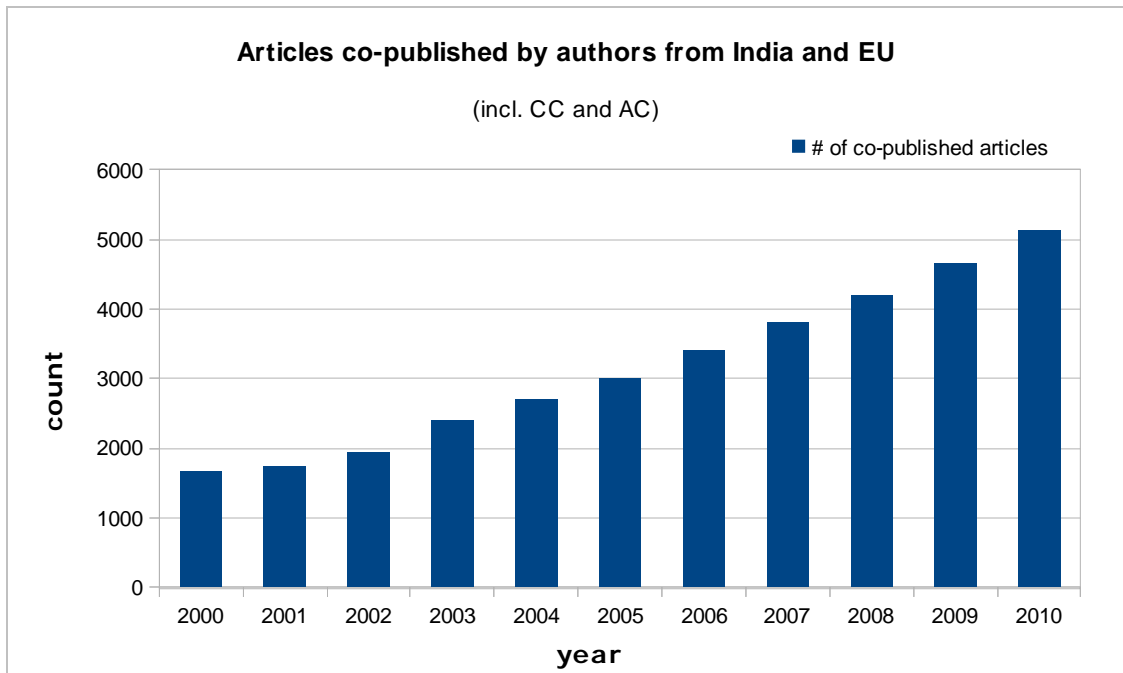
### Collaboration Dynamics – Results of the Co-Publication Study

As mentioned above, it is obvious that the overall number of co-publications involving authors from India has increased clearly over the last decade, but not in the same amount with different regions in the world. While for India co-publication figures with Japan, Australia, South Korea and China have multiplied, the steepest growth in mutual output numbers still was reached with the USA and the EU, with the last one having the highest numbers in total (see Figure 2).



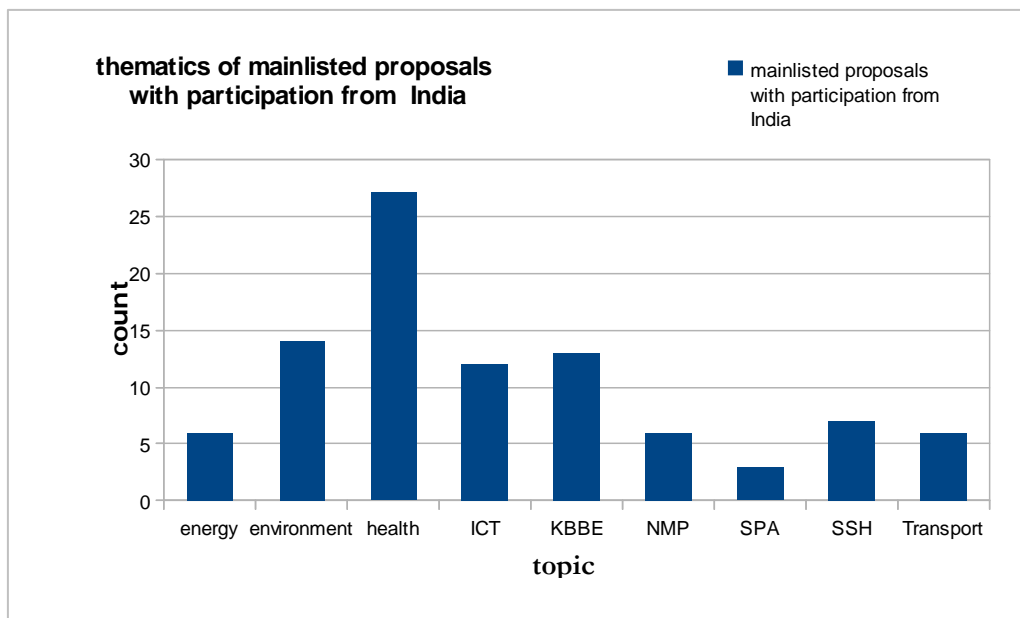
**Figure 1: Co-publications by India with its major research partners**

In Figure 3 we can observe the overall growth in the counts of annual co-publications between India and the European Union, including associate and candidate countries within the period of 2000 to 2010.



**Figure 2: EU-India co-publications in total**

More than the overall numbers, the thematic orientation of India-Europe S&T cooperation is of relevance for future related policy-making. Figure 4 shows the distribution of main-listed proposals involving Indian partners in the different thematic areas of the FP7 Cooperation Programme.



**Figure 4: Indian participation in FP7 by topics**

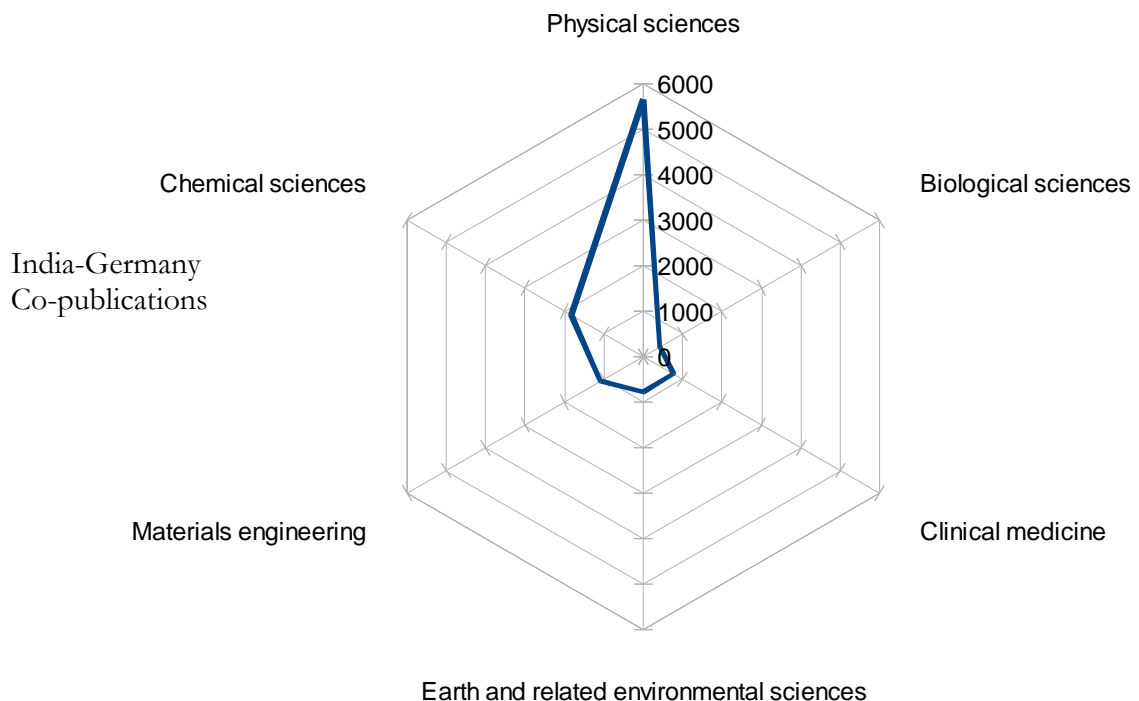
This can be compared to the most important thematic areas in India-EU co-publications. While it has to be noted that the FRASCATI area of physical sciences covers a wide range of sub-areas/topics and can therefore be expected to be prominent, its dominance still seems to

point out a core area of Euro-Indian S&T relations. The area is only partially covered by the thematic programmes in the FP7 Cooperation Programme (mostly NMP).

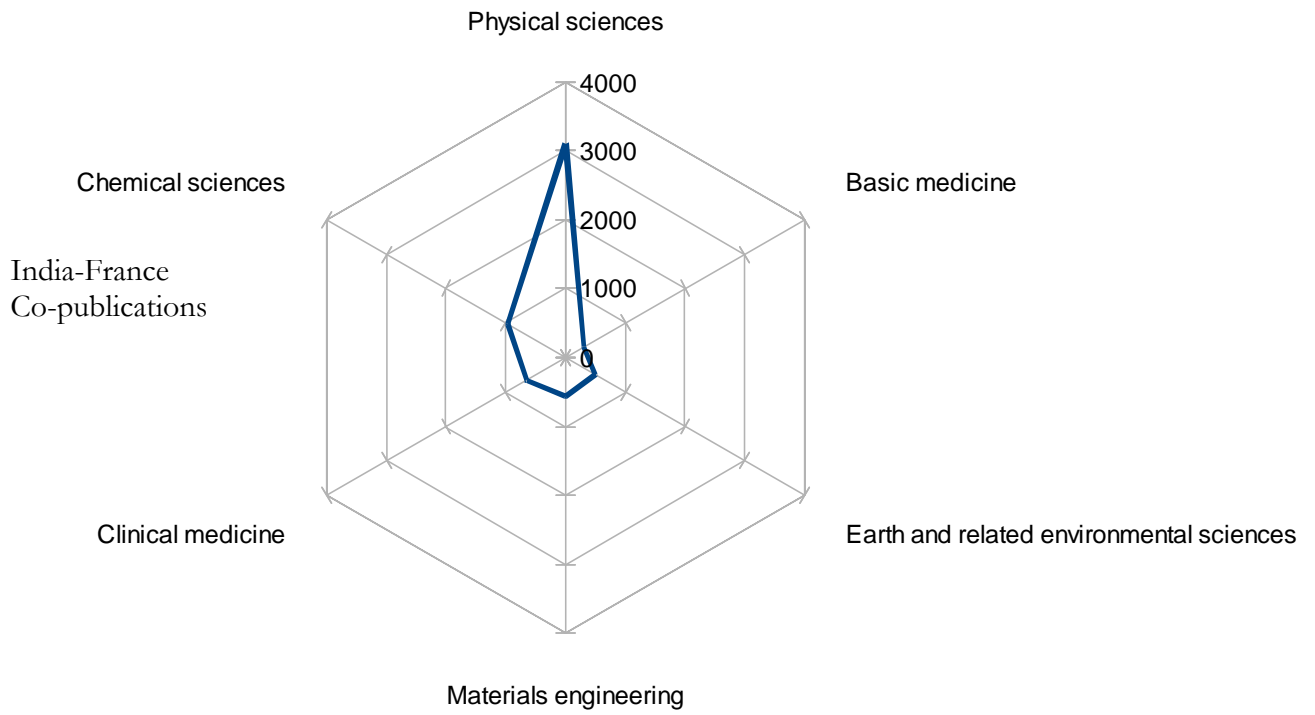
Frascati	name	count
1,3	Physical sciences	26237
3,2	Clinical medicine	7647
1,6	Biological sciences	7562
1,4	Chemical sciences	7127
2,5	Materials engineering	3529
1,5	Earth and related environmental sciences	3191
3,1	Basic medicine	2524
3,3	Health sciences	2281
1,1	Mathematics	1509
2,11	Other engineering and technologies	1406

**Table 1: Most important thematic areas in India-EU co-publications since 2000**

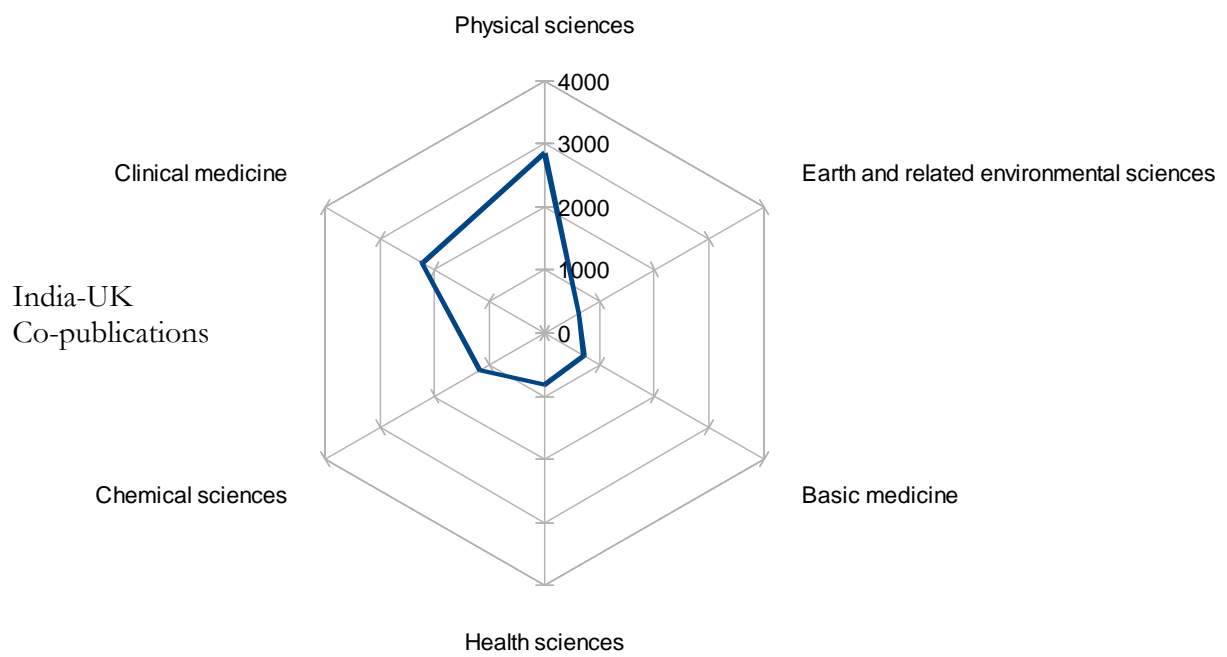
An analysis of the main subject areas in co-publications between India and specific EU MS/AC can also give interesting insights.



**Figure 5: India-Germany co-publications**

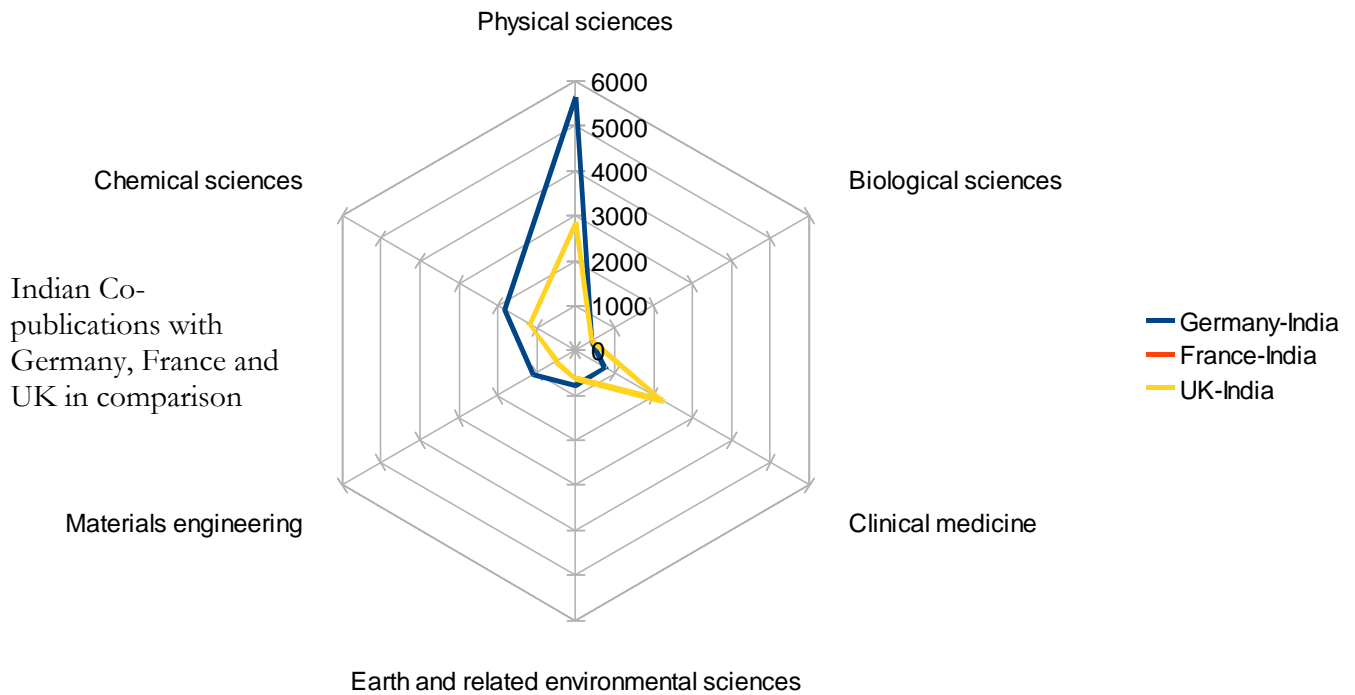


**Figure 6: India-France co-publications**



**Figure 7: India-UK co-publications**





**Figure 8: Co-Publications of India with Germany, France, UK per Fields**

Data on additional EU MS/AC and their co-publications with India can be found in the annex.

This quantitative data on EU-India co-publication as indexed in Thomson Reuters' Web of Science and Elsevier's SCOPUS databases can never replace, but definitely support STI policy's priority setting, in this case regarding EU-India cooperation. Combined with India's FP7 participation figures and country's own data of bilateral cooperation patterns, this analysis of the magnitude and thematic orientation of joint research output can stimulate policy discussions.

In addition to quantitative evidence (and for its interpretation), qualitative information from stakeholders, most notably from policy makers, programme owners and the scientific community, is needed. We have engaged these stakeholder groups at an early stage in the foresight exercise. The goal in this was not to ask e.g. the scientists about promising thematic areas for EU-India S&T Cooperation; at this early stage and without personal discussions, the risk was too high to get non-representative views promoting individuals' research agendas. Rather, we wanted to know what motivates scientists with cooperation experience (expressed in co-publication experience) to cooperate. These 'drivers' (= factors influencing how S&T cooperation between India and Europe might look like in 2020) can then be related to the drivers encountered in literature and in our own earlier similar analyses in other regions and, together, submitted back to policy-making and programme-owner stakeholders for consideration.

#### **4. Identification of drivers of future S&T cooperation**

In the following, we describe the series of steps undertaken in the process of driver identification and assessment that informed the subsequent scenario development work.

The material is to be considered as a kind of “evidence catalogue” inspiring further discussions rather than as a final set of drivers or a text for continuous reading. The goal was to engage the relevant stakeholders in a joint reflection process on why scientists cooperate and what they might need to intensify this cooperation. This approach also explains the reason why some of the drivers identified might seem trivial to expert readers and analysts. It would have been methodologically questionable for us to exclude or reformulate participants’ answers. Participants have to be picked up where they stand and accompanied to some more elaborate reflection on the reasons for international S&T cooperation. In addition, sometimes the obvious and seemingly trivial is the most relevant information.

Based on our previous work with policy makers and studying foresight literature we had a set of potential drivers identified from a policy-maker’s perspective available right from the beginning.

To generate a more holistic picture taking into account those actually engaged in S&T cooperation and involving them in the foresight process, we have consulted all the scientists that were identified in our co-publication study as having had recent (since 2005) EU-India co-publication experience. Via an open e-mail consultation we asked them to list the most important driving factors for research collaboration between these two geographic areas and got almost 600 qualitative responses.

The concrete request to the scientists has been:

***“Please let us know what you think has the highest influence on building-up and strengthening scientific relations between India and the EU.”***

Here are some impressions of recurrent issues addressed in the respondents' answers. In several occasions, respondents opted to report barriers rather than drivers. However, as barriers are a kind of negative driver, working towards their alleviation can be understood as supporting cooperation.

We grouped the answers into four categories: Bureaucracy, scientific cooperation issues, training and research areas.

- ..problems emerge for example in case you have to transport tissue specimen/samples from India to Europe or vice versa...
- ..helping successful collaborative applications with speedy contracts, MoUs or agreements..
- ..all websites of educational institutes in EU should be available in English..
- ...Visa issues are a huge barrier..

### **thinking about bureaucracy...**

- ..common research with not too high expectations may create a start because the key is always that we have to know each other..
- ..foster scientific exchange at large-scale facilities..
- ..include graduate students as parts of collaborative projects: for these students it is natural to continue cooperation for the rest of their life..
- ..as many Indian research institutes do not need money they would be rather interested to be included in the drafting of the calls..
- ..all kind of cooperation has to be built on mutual respect. Researchers have to meet to be interested in cooperation..

### **thinking about scientific cooperation issues**

- ..cross training in the different systems can lead to better understanding of the strengths and exploration of less well understood areas..
- ..differences among the various institutes in India are much more pronounced than in German or European universities ... one has to use much care to select the partner of collaboration..
- ..start joint graduate schools between institutions in India and Europe in specific areas of research..

### **thinking about training**

- ..joint development of agricultural engineering equipments and introducing farm engineering..
- ..develop equipments in Indian agricultural sector .. based on existing technologies at EU..
- ..identifying research priorities based on actual (societal) needs than based on desire for high tech and need to publish articles ..
- .. collaboration with India in nuclear energy technology through collaboration with Department of atomic energy (DAE-India in BARC, IGCAR) ..

### thinking about research areas

The entire set of answers, based on the researchers' personal experience, was qualitatively analysed with the goal of extracting (by coding the textual material) a **list of the most important driving factors** considered relevant by the scientists. The codes identified inductively and used for the entire corpus were: *barriers; country; (higher) education; funding; interpersonal/cultural; (science) policy; science/industry; misc.*

Here is the full list of **drivers extracted from the scientists' answers**:

- All websites of educational and research institutes should be available in English
- Disseminate and spread the word about available funds
- Offer efficient and fair review mechanisms
- Help successful applicants to quickly sign necessary contracts, MoUs, etc.
- Ease administrative requirements regarding the transport of tissue/samples
- Ease visa requirements
- “The gap in educational policies between India and the EU should be narrowed”
- Support scientists in the selection of suitable partners
- Support cross-training of graduates and postgraduates
- Start joint graduate schools
- Provide existing centres with dedicated funds for hiring outside postdocs/PhDs
- Create inter-regional Centres of Excellence with large-scale facilities for joint use
- Support S&T Cooperation in areas where
  - ... both India and Europe are strong
  - ... where India is stronger
  - ... where Europe is stronger
- Orient S&T cooperation priorities towards global or regional challenges
- Include poor or vulnerable communities in the decisions on priorities
- Adopt a bottom-up approach to the support of S&T cooperation
- “Researchers have to meet...and to be interested”
- Periodic Indo-EU conferences, workshops
- Support more long- and short-term exch.
- Mechanisms for young scientist exchange maybe even undergrads
- “What if the work doesn't suit my skills?” → trial periods in exch. and joint degrees
- Help adjust expectations to realities on the ground
- Address recruiting possibilities: best students leave towards IT industry

- Encourage joint research with industry
- Involve multinationals cooperating with Indian research institutes
- Link EU research institutes to Indian private sector

This is the list of **drivers that we assembled using existing literature and our own experience in policy-makers cooperation foresights:**

- Tackling global challenges jointly
- Funding and donor availability
- Favourable policy background
- Availability of (scarce) human resources
- Ease of mobility and brain circulation
- Brain Gain – Make it attractive for PhDs to return
- Diversified cooperation partners should be available
- Bi-regional ‘science days’ (events)
- Support for co-authored papers
- Research management support
- Support for research infrastructures
- Schemes for joint usage of infrastructure
- Research and education platforms
- Common standards (metrology, etc.)
- Agreement and information on IP issues
- Drivers identified by literature and policy makers (cont’d)
- Mutual respect
- Joint degree programmes
- PhD capacity building programmes
- Courses in a common language (Eng.)
- Internationalisation of education
- Bologna process
- Support for national innovation sys.
- Support academic – business – government links
- Engage SMEs in doing R&D
- Adopt a ‘pro-poor’-approach
- Removing mobility barriers
- Removing trade barriers

Both sets of drivers, the ones from literature and the ones from the online scientist survey, have been considered by **programme-owner participants** in a small **foresight session during a New INDIGO event in Brussels**. The following table shows the ‘drivers’ considered by the participants to this workshop to be most *relevant, feasible* (to act upon) and *urgent*:

<b>Drivers considered most relevant, feasible to act upon and urgent by programme makers</b>	<b>relevance (points)</b>	<b>feasibility (aver.; 1-4)</b>	<b>urgency (aver.; 1-4)</b>
Support for research infrastructures	9	3,3	3,1
Removing mobility barriers	8	3,1	3,6
Support S&T Cooperation in areas where both regions are strong	7	3,6	3,6
Disseminate and spread the word about avail. Funds	7	3,3	3,1
Address recruiting possibilities (not to loose the best students to industry)	7	3	3
Internationalisation of education	7	2,9	2,9
Brain gain – make it attractive for PhDs to return	6	3,1	3,7
Joint graduate schools in specific areas of research	6	3	3,3
Schemes for joint usage of infrastructure	6	2,6	3
Common standards	6	3	3,2
Ease visa requirements	6	3,4	3,4
Adopt a bottom-up approach, dedicating funds to S&T cooperation in general, not to specific thematic areas	6	3	3
Dedicated funds for hiring outside PhDs	5	3,6	3,6
Orient S&T coop towards global challenges	5	3,5	4
PhD Capacity Building Programmes	4	3,6	3,1
Funding and donor availability	4	3,1	3
Research management support	4	3,3	2,9
Offer efficient and fair review mechanisms	4	3,4	2,8
“Researchers have to [be able to] meet...”	4	3,3	3,3
Ease of mobility and brain circulation	4	3,2	3
Support academic-business-government links	4	3,1	2,6
Research and education platforms	3	3,3	3,3
Joint degree programmes	2	3,3	3

**Table 2: Drivers considered most relevant, feasible to act upon and urgent by programme makers**

With regard to ‘*relevance*’, participants were invited to assess how important each of the drivers is for the future development of S&T cooperation between India and Europe. Each participant could distribute a maximum of 24 relevance points over the whole set of drivers (in sum 55). The above list is a selection of the most important ones.

‘*Feasibility*’, in this context, means the possibility to act upon the driver under consideration. There is a possibility that factors influencing future cooperation are relevant, but cannot be influenced – their feasibility value would then be low, in our ranking. The ‘*urgency*’ value responds to the question how quickly policy-making should try to positively influence the driver under consideration.

Both ‘feasibility’ and ‘urgency’ have been assessed using a four-point scale (not feasible = 1, feasible = 4; not urgent = 1, very urgent = 4). Participants were invited to rate only those items that they considered relevant. Unanswered items were coded with 0 and not taken into account when calculating the average value. That is, the feasibility and urgency ratings have to be interpreted as the opinion of those considering the respective driver relevant. The number of those who consider a specific driver relevant can be deducted from the relevance counts.

**Further drivers** that have been proposed by this group of participants include (their relevance, feasibility and urgency could not be assessed as they were newly added by individuals):

- the role of China as a “first mover”
- the level of wages and the availability of manpower
- knowledge about the Indian S&T landscape in Europe
- infrastructure for mobility (guesthouses, etc.)
- faster procedures, better understanding of funding
- more staff in R&D management
- size of available market/wealth
- economic growth/macroeconomic situation
- FP8 priority setting
- Long-term policies
- Development of regional bodies

This driver set was also discussed in a series of five expert interviews with Indian policy-makers<sup>17</sup> in May 2011 that aimed at defining when Indian stakeholders would consider a 2020 future of EU-India S&T cooperation a “success” (what indicators would they use to assess the future scenario?, etc.) and what relevant social, technological, economic, environmental, political and value based factors would have to be taken into account (STEEPV).

Some interesting flashlights from the interviews:

- The ongoing efforts in India to address the 800/300 divide (among the 1.1 bio. citizens, 800 remain poor) will affect the purpose of science and also S&T

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<sup>17</sup> From the Department of Biotechnology (DBT), the Council for Scientific and Industrial Research (CSIR), the Confederation of Indian Industries (CII), the Foreign Ministry and CEFIPRA (the Indo-French Centre).

collaboration until 2020 and beyond; science has to serve the 800 mio., while the 300 mio. can more or less care for themselves (and engage in science)

- If 2020 sees no improved situation for the 800 mio. poor, there might be social upheaval.
- India's growing energy demand has to be addressed; one of the visions for 2020 here is to produce 22.000 MW from solar power; research into these issues is currently almost exclusively government funded; this should change.
- 2020 will see the availability of a large, increasingly well trained Indian workforce
- Indian diaspora scientists will continue to play a key role
- Programmes will be extended that aim at bringing back selected overseas Indians with PhDs. They will be important for international collaboration also once they are back in India.
- While the largest number of Indian students will still prefer to go to the US, increasingly available English language PhDs and MAs in European universities will attract a higher number of Indian students as well,
- Research funded at state-level is currently minimal in India. This might change. Currently, some states show more initiative than others. This depends very much on the state government as well as on the available resources (because of industry presence, etc.). The more active states include: Karnataka, Andhra Pradesh, Gujarat, Haryana, partly Kerala.
- The number of central government funded universities (including IITs and IISc) will increase. These can and will be major hubs for S&T cooperation in 2020.
- The number of (internationally) shared research facilities is likely to grow
- The public investment in R&D will continue to grow.
- Indian scientists, up to now, have been interested in publishing, not in filing patents (does not help their career development)
- The challenge of resolving the trade-off between inclusivity and the support of excellence will remain.
- With regard to the selection of topics, a possible increasing number of bottom-up programmes will be combined with a still important top-down approach informed by a general perspective rather than sector/discipline interests.
- Share of private investment in R&D has to increase (currently only around 25%).
- Until 2020, sectors where India is currently still rather relying on technology transfer (e.g. manufacturing/machinery) will increasingly see innovative activity.
- Incentive systems are already in place (200% tax reduction, not only for in-house R&D, but also if carried out in public research labs), but few players (200 companies are registered for the tax reduction; very few get it continuously, i.e. their R&D efforts are not sustained; very few big players like Tata Steel, Tata Motors and Tata Chemicals)
- In 2020, a much higher number of Indian industries will be patent owners (not only MNCs in India)
- The number of co-patents (and their degree of commercialisation) will be an important indicator for a successful 2020 future of collaboration (together with co-publications).
- In this regard, efforts will be interesting to look at that bring firms in India and Europe together to establish joint labs and engage in co-patenting.
- Increasing role of tripartite public-private-partnerships (CII-DST-state government)
- Increasing role of industrial R&D programmes as part of bilateral S&T programmes (e.g. 25/25/25/25: industry partners and governments from the two countries involved each contributed 25%)



- Joint research centres/labs are likely to play a stronger role (like the joint Indo-German labs)
- In 2020, there will be a series of centrally funded so called Innovation Universities in India
- Values might be an issue with regard to stem cell research and green biotechnology. However, especially among the population with access to formal education, according to the expert it is not likely that this will be a big problem
- South-South-partnerships will be increasingly important (recently, the first South Asian university has been created)
- With regard to other partners, the US is likely to continue its rather rigid approach not facilitating bilateral programmes. Australia and Canada are currently very active, but partly not yet ready to invest money. This might change until 2020. However, with Canada the problem remains that, contrary to India, most of the money is available at state, not central government level. India cannot sign MoUs with every Canadian state...

As outlined in figure 2, not only programme makers/administrators and policy makers, but also scientists are invited to personally (not only virtually) contribute to the success scenario discussions and, concretely, to the identification of the relevant drivers adding up to it.

In this regard, we have organised a **workshop with high-level scientists from India** in Thiruvananthapuram/Kerala in May (● in the above flowchart). A group of around 10 senior scientists were invited to consider the set of drivers identified by their peers in the open email consultation.

While it is not necessary to present the findings of this workshop in detail, here, we do want to give some indications if and how the scientists' views differed from the assessments collected in the course of the programme maker workshop.

Many of the drivers considered particularly relevant by the scientists were also mentioned as important by the programme owners. The scientists did, however, emphasise a few aspects to a higher extent than the programme makers:

For instance, they considered the creation of a number of **inter-regional Centres of Excellence with large-scale facilities for collaborative** (not exclusively in-house) research relevant.

Likewise, support to both **long and short-term visitor programmes** was identified as boosting long-lasting collaboration. Linked to discussions of the potential of mobility was the proposal of some sort of **compensation for the social costs** involved in academic mobility, especially regarding longer-term stays. The scientists gave examples from their own life: For instance, one of the participants has worked for several years doing successful research in Europe. Now he has returned to an attractive position offered to him in an Indian government research lab. It is unclear what will happen to his contributions to European pension funds.

Similarly pointing to administrative challenges, the scientists underlined that **websites of educational and research institutes should all be available in English**. Furthermore and more closely linked to actual research collaboration: Despite the fact that some regulation is available (e.g. in the framework of the ICMR and its bilateral agreements), more has to be done to facilitate **tissue and biomaterials exchange** between India and Europe.

After these fruitful discussions, the **a Delphi Survey** has been launched in the form of an online survey that invited scientists with recent India-Europe co-publication experience (since 2005; same target group as above) to assess and comment upon the drivers identified (in a sense, this online survey has been the second Delphi round if we consider the email consultation on driving factors the first). Concretely, they were asked to assess *relevance* and *urgency* of each of the drivers. Two reasons motivated us not to ask the scientist respondents to assess feasibility: First, we did not want to make the survey longer and more complicated. Secondly, it's rather the policy-makers and to a certain extent the programme managers who can assess the feasibility of acting upon different drivers for cooperation.

In this Delphi round, a response rate of around 6% and a total number of 891 complete surveys have been received.

If we look at the relevance ratings assigned by the respondents, the means of the answers range between 1.2 and 2.1, i.e. in general very high<sup>18</sup> – most of the drivers presented were considered relevant. Parts of this rather uniform ranking already in the first Delphi round might be explained by the fact that the scientists, against explicit advice, considered the list of drivers a kind of wish list and answered following the principle of “the more the merrier”. However, differences in the degree of assigned relevance can be detected even in the light of general consensus that all drivers are at least “rather relevant”.

Drivers that more than half the respondents considered very relevant (relevance = 1):

**Most important drivers for EU-India S&T cooperation according to scientists with cooperation experience**

[Administration] All websites for educational and research institutes should be available in English

[Administration] Disseminate and spread the word about available funds.

[Administration] Offer efficient and fair review mechanisms

[Administration] Ease administrative requirements regarding the transport of tissue specimen/samples

[Mobility and Contacts] Researchers have to meet and to be interested to have collaboration, also to go from Europe to India or from India to Europe

[Mobility and Contacts] Both the partners have to learn to adjust their expectations to suit the ground realities

[Mobility and Contacts] Support more long- and short-term visitor programmes

[Mobility and Contacts] The social costs of S&T cooperation (travel, stays abroad) should be taken into account.

Interestingly, no driver in the groups “Thematic Priorities and Research Administration”, “Higher Education and Research System”, or “Science-Industry Linkages” has provoked the same degree of unanimity.

Regarding the question whether it is more reasonable to support S&T cooperation in areas where either one side is stronger or both sides are equally strong, we recognised differences between the respondents stating that they are answering from an Indian perspective in

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<sup>18</sup> (1 = very relevant; 2 = rather relevant; 3 = somewhat relevant; 4 = not very relevant; 5 = not relevant at all)

comparison to those that answered from a European perspective: 60.7% of the Indian respondents and 78.2% of the European respondents stated that both sides shall already be strong, while 36.1% of the Indians but only 16.4% of the Europeans stated that it is more reasonable to support areas where Europe is stronger.

The goal of spreading the information on the drivers further was not so much to simply get yet another relevance assessment. Foresight is much about engaging people in a structured dialogue (cf. Miles 2005). Hence, the fact that a larger group within the scientific community reads through and thinks about the ‘drivers’ proposed to be important for future S&T cooperation by their peers and other stakeholders, is in itself a goal of this exercise. People should have the opportunity to comment upon the state of the discussions on future cooperation in order to ensure both that they are and feel involved and that the ownership remains with the stakeholder groups.

## 5. Success scenario generation

After this intense foresight process phase of driver identification and assessment, the tools were available for building and defining scenarios. Due to limited resources and the mandate of this foresight exercise, we have chosen a normative success scenario approach, where drivers with different values assigned to them are combined to a series of different yet all optimistic scenarios, out of which one is chosen as a normative orientation.

It was a methodological challenge that we had only one afternoon at the New INDIGO Executive Board meeting at our disposal for the scenario development.

To make the most out of the severely limited time, we have given a short outline of preliminary results as a recommended ex-ante reading or ‘handbook’ for the participants in the success scenario workshop (European and Indian policy makers, mostly from Ministries in charge of S&T policy), which took place in Bilbao/Spain in June 2011 ( in the above flowchart). An input presentation was prepared as well as the most relevant drivers presented on paper cards allowing to “play around” with them.

We invited participants to engage in highly interactive small group discussions of the drivers identified and their possible combinations, in order to come forward with what would be the **2020 success scenarios of bi-regional S&T cooperation between India and Europe.**

The questions guiding the discussions were:

- What would characterise a successful 2020 cooperation future? What ‘drivers’ form part of it?
- How would the environment look like for scientists engaged in India-Europe S&T cooperation in 2020?

The discussions in small groups and in the plenary made use of the relevance, feasibility and urgency assessments of the drivers indicated above, in order to narrow down the scope of aspects to be taken into account. For instance, discussions of what drivers would combine to a successful future started with those drivers considered most relevant and/or urgent by other stakeholders.

The New INDIGO Foresight Team has prepared a series of ‘forecasts’ (possible 2020 ‘values’ of each of the drivers; e.g.: what level of funding; what type of common standards; or joint PhD programmes or not). Participants were able to select drivers that they feel should form part of the success scenario. They could then decide on a suitable forecast, selecting one from those prepared by us in desk research or adding new ones. Drivers and forecasts could then finally be combined to a success scenario.

The discussions also considered interdependencies between different drivers. For instance, the existence of joint PhD programmes in 2020 is linked to the driver of “brain circulation”, as common standards are relevant to get the industry engaged in cooperation, etc.

The **output** of the workshop were sets of key drivers/variables with their interdependencies and 2020 values highlighted, that together form **2020 success scenarios**.

These are the **success scenarios** elaborated by the policy makers and presented to the European scientist workshop (see below) for consideration:

### ***Success Scenario “Facilitating – Funding – Training”***

By 2020, success in EU-India S&T Cooperation in 2020 has been achieved by supporting activities in each of the three areas of facilitating, funding and training.

With regard to the facilitation of cooperation, researchers have funds and fora available in order to meet their Indian/European counterparts. Research funding schemes offer dedicated project top-up funds for mobility. Barriers for mobility such as burdensome visa procedures have been removed. Common standards will be in place together with a standardisation of IPR issues, allowing for a fair treatment of each partner in bi-regional consortia and avoiding additional administrative effort for the coordinator of joint projects. Formalised cooperation will have increased, for instance in the form of agreements between standardisation agencies (standardisation, joint testing, measurement, etc.).

As to funding, the availability of dedicated financial resources will be significantly higher in 2020, coupled with an increased and explicit donor commitment. Regular bi-regional calls for proposals with real joint funding (as well as virtual common pot funding programmes complementing bilateral programmes), complemented by co-funding from the European Commission, are in place. Scientists can benefit from exchange schemes in the frame of specific research infrastructure. In order to allow scientists to quickly find information and access to EU-India S&T cooperation funding, a single entry point (e.g. in form of a website) for all Indian-European research funding offers is available. The results of successful joint multi- and bilateral S&T cooperation are presented to an interested business community in dedicated showcasing conferences, facilitating academia-business linkages. Moreover, R&D activities of small and medium enterprises (SMEs) are scanned both in India and Europe and showcased in both regions. Successful or potentially research performing SMEs will be approached and possible public research partners will be presented to

them. Finally, dedicated funds are available (as part of wider S&T cooperation funding) for hiring outside PhDs who can support the creation of and stabilise long-term exchange between senior scientists.

When it comes to training, a central virtual platform exists for preparing, accompanying and motivating multilateral joint research as well as for the development of joint degrees and the exchange of PhDs in sandwich programmes. Activities and results are presented in actual workshops once a year. These support structures could trigger significant brain gain, for instance when an Indian fellow spends two years of his/her PhD in the UK and the rest of the time in India or vice versa. Also for the sake of brain gain, postdoc exchange schemes exist to support young scientists in coming back to their home institutions (and countries).

There are also mechanisms in place for the development and quality control of joint PhD programmes. Joint programmes take advantage of online and virtual learning systems, e-lectures, etc.

### ***Success Scenario “Focusing within Diversity”***

In 2020, there will be different instruments in place combining strategic planning with bottom-up approaches in order to identify and prioritise *challenges common* to Europe and India which can then receive dedicated funds for S&T cooperation. These instruments combine the integration of national strategies with expert advice and civil society participation.

Cooperation is not so much focusing on global issues, but somewhat more specifically on areas where India and Europe encounter challenges. Within these encountered and prioritised common challenges, the approach is quite bottom-up, i.e. scientists can propose collaborative research projects. The channels are identified, so to speak, and the research groups will appear with concrete proposals. The advantage of this approach is that not only applied, but also basic research is attracted.

In terms of funding instruments, virtual and real common pot funding combined with add-ons from the European Commission to the bilateral programmes (for incorporating third country partners in bilateral relationships or generally for cooperation efforts) is available. By this means, support for cooperation relies on what already exists instead of reinventing the wheel or doubling the efforts.

International cooperation projects within the EU Framework Programme will be reinforced and improved (they are, for instance, more visible than in 2011). The FP7 Specific International Cooperation Actions will have been made less Eurocentric by 2020.

In this scenario, the Bologna process is supported in both regions over the decade 2010-2020. Recognition of academic qualifications and credit transfer is ensured. Mobility and specifically brain circulation are encouraged and supported. Brain circulation is facilitated through

the support of career development designing research careers that envisage, for instance, a starting period in the home institution with a year abroad and the last year of the PhD back in the home institution. Several relevant aspects regarding mobility have been learned by 2020: For instance that researcher mobility is also the mobility of the family. It involves visa issues (ideally, ERA would be a single area from the point of view of Indian scientist mobility to Europe), schooling, social security transfer, etc. In this success scenario, all these aspects will be explicitly addressed and dealt with by 2020. The potential of senior scientists has successfully been harnessed: they can participate in preparing and managing mobility and visit the respective other region themselves as mentors. As regards the high relevance of common standards beyond recognition of academic qualifications and track records, standardised rules for IPR as well as access rights will have been put into place by 2020. There will be common publication rules and increasingly standardised research methodologies. Joint standards for clinical trials will be in place.

### ***Success Scenario “Complementarity and Mutual Strengths”***

By 2020, researchers will be in contact, visit each other and exchange as normal parts of their everyday work. Cooperation will focus on areas where both regions perform excellently. Joint research infrastructures will exist where researchers and students are learning from each other. Teaching/learning and research is combined in these facilities. These infrastructures could also very well be virtual networks. The standards needed for efficiently working together in joint infrastructures are agreed upon. Joint degrees at PhD level as well as virtual learning platforms are in place. Support structures for academy-business-government links are put in place.

In the course of the next decade until 2020, Indian-European S&T cooperation will be increasingly built on empathy/trust based on long-term personal and professional relationships as well as commitment from the side of policy-making and funding institutions. The trust built helps to lower the risk that people compete instead of working together. It also fosters a mentality of mutual understanding.

These success scenarios can be further integrated, circulated and fed back to the other stakeholder groups in scenario validation, followed by backcasting exercises looking into the question how to reach to this successful 2020 future.

Due to resource constraints, we were only able to have one live scenario validation workshop.

## 6. Scenario validation

A group of ten European scientists (who have cooperation experience) has been invited to **discuss the draft scenarios along the following questions in a dedicated scenario discussion workshop** in Paris on 15 September 2011 (● in the above flowchart):

- What does European-Indian S&T cooperation look like up until now (co-publication; FP7 participation)?
- What would be considered ‘success’ in 2020 S&T Cooperation between India and Europe?
- What measures have to be taken in the present to reach that situation?
- Are there any specific needs or developments per scientific area?

The main comments directed to the different scenarios have been the following:

### *Ad Success Scenario “Facilitating – Funding – Training”*

- what about established networks/groups, senior scientists, institutes? Is that a trend?
- Sustainable platforms; as part of a European effort!
- Ad “formalised cooperation will have increased [...] (standardisation, joint testing [...]); also: data samples!
- Ad financial resources: public resources, philanthropic resources
- Ad specific research infrastructure: access to infrastructure
- Ad single-entry point: transparent and uniform evaluation of quality and evaluation after the projects
- Ad presentation of results to business community: what about the wider society? the society as a watchdog? → within science as well as with regard to peer review (transparent, rigorous)
- Ad hiring outside PhDs: postdoc short-term mobility in both ways!
- Ad brain gain: brain circulation as an important concept!

### *Ad Success Scenario “Focusing within Diversity”*

- Not only integration of national strategies, but of national programmes
- Ad Bologna process and recognition of qualifications: coherent, but is this realistic?
- Brain circulation and mobility as an important point!
- Harmonization of curricula as an additional aspect

### *Ad Success Scenario “Complementarity and Mutual Strengths”*

- is it feasible to practice “exchange as normal parts of their everyday work”?
- if cooperation is strong, why should we support it?
- Students are not only learning from each other, but “enabled to” learn from each other
- Comment: “It is not about strengths or weaknesses, it is about people!
- Ad joint degrees: multidisciplinary!
- Ad infrastructures: they could not so much also BE virtual networks, but include virtual networks: for different sciences at a different level.

In general terms, it was commented that the scenarios overlap and cannot be clearly separated. This is true and due to the process of creating the scenarios. They have been elaborated by different subgroups in the policy-makers scenario workshop in Bilbao (see above). We have chosen not to change or combine the scenarios at this point in the process.

There were also some other general questions leading, among other things, to the following interesting additional considerations:

- Drivers for science and drivers for scientists could be treated differently
- There is one additional relevant driver for the European side that might be important: The EU asks itself whether it will be important in the future, in general and for countries like India. Keeping a centre of gravity of world research and economic development in Europe might be a driver for cooperation on the European side, particularly for policy-makers, but also for scientists.
- It might be worthwhile to ‘dig deeper’ in the foresight exercise and identify, for instance, specific challenges for cooperation of individual institutions. However, this is not possible with the resources of this foresight exercise. Venturing into the level of individual institutions without sufficient resources to cover a representative set of them, might provoke a problematic dominance of singular perspectives.

The results of this scenario discussion workshop have been integrated into the New INDIGO Foresight Exercise in the form of a **consolidated success scenario**, which entered its final stage with a workshop focusing on short-term programme recommendations.



## 7. The consolidated success scenario – long term recommendations

The consolidated success scenario, resulting from the three draft scenarios and the scientist workshop's comments, focuses on facilitating, funding and training. More concretely, it contains the following aspects formulated in the way of long-term recommendations:

### facilitating

- acknowledge and capitalise on the important role of established multidisciplinary networks: Multidisciplinary networks existent over longer periods of time ensure mutual trust and establish sustainable entry points for other researchers interested in cooperation.
- make available top-up funds for mobility: Particularly the scientist stakeholders expressed that for cooperation, face-to-face interaction is crucial from time to time. By this means, established contact is not lost, but kept alive. Researchers then tend to also have their colleagues from the other region in mind when going for future research projects, etc.
- allow for brain circulation, removing barriers for mobility and facilitating career development: Related to the recommendation regarding mobility, it is important that human resources circulate without leading to brain drain effects for one of the regions involved. Mobility and research cooperation should become integral parts of researchers' careers with appropriate incentives and reward systems.
- ensure common standards (methodology, data, samples, evaluations) and formalised institutional cooperation: Common standards as well as formalised institutional cooperation (e.g. between standard setting agencies, but also universities) add a practical dimension to cooperation efforts. It is easier for research teams if they can share data and samples (e.g. biomaterials) for common research purposes. Likewise, it is helpful if researchers from one region can rely on the metrology and standard of evaluations of the other region's standard setting and enforcing bodies. When looking at evaluation standards in research funding agencies, this point is also linked to the following dimension addressed by the consolidated success scenario.

### funding

- allow for financial resources (public and, increasingly, philanthropic): It might sound obvious, but it is crucial that dedicated resources are available if researchers see an opportunity and wish to engage in joint collaborative work. Taking into account general trends in the funding of publicly relevant research, philanthropic resources will be more relevant and increasingly be tapped into in our 2020 scenario.
- enable access to joint and national infrastructure: This not only helps to make the most out of expensive infrastructure, but also ensures that research teams can physically meet at the location of central infrastructure used in joint projects. In case certain infrastructure or equipment is only available in one of the participating regions, it should be avoided to completely exclude the other party from using this infrastructure. By offering access and jointly using national infrastructure, an important training element can be added to joint research efforts. Another option increasingly relevant in the future could be infrastructure that is actually jointly acquired and open for use for both sides.

- offer a single-entry point for information: Scientists interested in or in need of opportunities for collaboration with the target region (India for Europeans and vice versa) should not face the burden of multiple and non-transparent communication channels, i.e. they should not waste their time looking from where to get the right information from. One portal should act as an information one-stop-shop for cooperation between two regions (ideally, this would be linked to platforms focusing on other regions).
- present results to interested business communities: It is a challenge to fund public or public cooperative research. Moreover, it is a constant challenge for science to make possible users aware of the knowledge available, jointly transforming it into applications. Bi-regional cooperative research faces the same challenges. However, it has the advantage of offering access to, in principle, business communities from both regions. Formats should be found to present the results and possibilities of joint research to business communities in ways that take into account the private sector's needs and limitations (e.g. fear of losing competitive advantages or intellectual property when disclosing investment decisions and research interests).
- approach SMEs with potential for R&D: Collaborative research could and should also increasingly be used as a leverage to help SMEs to extend their R&D activities. Supporting by mappings of the private SME landscape, possibly interested SMEs can be selected and approached for discussions of efforts in exploiting results of joint research.
- make available dedicated funds for 'outside' PhDs and two-way postdoc mobility: Many respondents made clear how important young researchers are for establishing and, even more, maintaining S&T cooperation between two and more labs. While the senior researchers often have little time to spend longer periods with the partners in the other region, it is the junior researchers who can sustain the collaborative momentum in doing actual work together over longer stretches of time. Through their reporting back to the senior researchers, these also remain in touch and align their research agendas. PhD and postdoc exchange is also relevant for ensuring comparable standards in teaching and research. These and other reasons indicate that it would be a great instrument for professors to have some bottom-up resources (linked to their research) at hand when inviting foreign PhDs or engaging in postdoc exchange.

### **training**

- offer training schemes including mobility for brain gain: Training is often the first step towards full-fledged research cooperation. It is also crucial in alleviating weaknesses in a region's curricula and research activities. Trainees should not be considered a mere cost, but can effectively be used for own research tasks, in addition to and as part of their training.
- establish joint PhD programmes: While in the short run, joint PhD supervision can also be realised without formal joint PhD programmes, the more sustainable long-term goal of formalised joint PhD programmes can help university faculties in ensuring junior researcher exchange and collaborative work at similar standards of teaching and research.

The success scenario in its complete **textual** form reads as follows:

By 2020, success in EU-India S&T Cooperation has been achieved by support to activities in each of the three areas of *facilitating, funding* and *training*.

With regard to the *facilitation* of cooperation, researchers have funds and fora available to meet their Indian/European counterparts. A significant number of **established multidisciplinary networks** of groups and senior scientists form the core of ongoing cooperation. Research funding schemes offer dedicated project **top-up funds for mobility**. Barriers for short and long-term mobility such as burdensome visa procedures have been removed and, at the same time, **brain circulation** channels have been opened that also facilitate career development.

**Common standards** are in place together with a standardisation in the area of IPR, allowing for fair treatment of each partner in bi-regional consortia and avoiding additional administrative efforts for the coordinators of joint projects. **Formalised** institutional cooperation has increased, for instance in the form of agreements between standardisation agencies (standardisation, joint testing, measurement, data, samples, etc.). Evaluation of collaborative projects and ex-post evaluation of project outcomes is uniform and transparent.

As regards *funding*, the availability of dedicated **public as well as philanthropic financial resources** is significantly higher in 2020 than it was in 2010, coupled with an increased and explicit donor commitment. Regular bi-regional calls for proposals with real joint funding (as well as virtual common pot funding programmes complementing bilateral programmes), complemented by co-funding from the European Commission, are in place. Scientists benefit from exchange schemes in the frame of specific research infrastructure in both regions as well as from **access to joint infrastructure**. In order to allow scientists to quickly find information and access to EU-India S&T cooperation funding, a **single entry point** information hub (e.g. in form of a website) for all Indian-European research funding offers is available. The results of successful joint multi- and bilateral S&T cooperation are presented to an **interested business community** in dedicated showcasing conferences, facilitating academia-business-society linkages. Society is involved in designing cooperation policy, priorities and the goals of collaborative research, while science itself applies a transparent and rigorous peer review mechanism.

R&D activities of small and medium enterprises (SMEs) are scanned both in India and Europe and showcased in both regions. Successful or **potentially research-performing SMEs** are routinely approached to be updated on possible public research partners.

Finally, dedicated funds are available (as part of wider S&T cooperation funding) for **hiring outside PhDs** who can support the creation of and stabilise long-term exchange between senior scientists. **Two-way** short-term mobility of postdocs, postdoc exchange schemes supporting young scientists to come back to their home institutions (and countries), and similar programmes are also facilitating brain circulation.

When it comes to *training*, a central virtual platform exists for preparing, accompanying and motivating multilateral joint research as well as for the development of joint degrees and the exchange of PhDs in sandwich programmes. Activities and results are presented in actual workshops once a

year. These support structures trigger significant **brain gain** in combination with mobility schemes mentioned above, for instance when an Indian fellow spends two years of his/her PhD in Europe and the rest of the time in India or vice versa.

There are mechanisms in place for the development and quality control of **joint PhD programmes**. Joint programmes take advantage of online and virtual learning systems.

## 8. Selective backcasting – Vienna Foresight workshops

The New INDIGO Foresight exercise is tasked to come forward with a series of policy recommendations. Apart from the long-term perspective, which is contained in and addressed by the consolidated scenario as well as the comments on the draft scenarios (from the scenario workshop and the scenario validation workshops), it seemed important to have some short-term guidance on where to start working towards a favourable future cooperation scenario. The case and experiences of the multilateral calls within the New INDIGO consortium have been used as examples for the short-term recommendations to focus on (as the design of upcoming activities similar to or different from the New INDIGO ERA-Net is something where bi-regional EU-India collaboration can effectively be influenced in the short and medium term).

With this goal in mind, a foresight workshop was held on 30 November 2011 prior to the 2nd EU-India S&T Cooperation Days. The roughly 15 participants were programme managers from Europe and India on the one hand, and Indian scientists on the other.

Two main arguments suggested holding this workshop with a combined participation of (mostly) Indian scientists and programme managers from both regions: The people designing the programmes are in an intermediary position between the policy goals and the scientists' actual work. They are best suited to discuss short-term implications of the 2020 success scenarios and can help formulate programme recommendations that can be implemented in the next 2-4 years. The Indian scientists, on their part, can comment on the suitability of the proposed programme recommendations and help to refine them. In addition, by involving them in this half-day workshop, they got the opportunity of joining the process, once again, after the scenario formulation (as their European peers have done in Paris).

The workshop started by inviting participants to consider one to three drivers identified as relevant in the driver assessments and think about what could and should be done in the short term with this driver in order to work towards the consolidated success scenario. As a next step, participants gathered in small groups, each of them discussing drivers related to each other in the following dimensions:

- Extended programme context
- Science/industry linkages
- The search for thematic priorities
- Call publishing, funding modes & reporting/monitoring
- Network setup
- Higher education issues

The groups presented the recommendations they identified for their driver, commented upon the others' recommendations and formulated additional recommendations in the area they are working on. The recommendations proposed by the groups were presented to the plenary, discussed and complemented.

The output of this workshop is the following set of structured short-term recommendations for multilateral S&T cooperation programmes:

## 9. Short-term recommendations

### Extended programme context

- Ensure that **no multiple approvals are required for repeated visits** within a project (inform embassies/foreign ministries/VFS)
- Provide longer-term **multiple-entry visas** linked to project duration
- Jointly publish **common methods and standards**, validated among various labs to secure global acceptance and facilitate collaboration
- Develop a **common set of rules for shipment/exchange of recombinant human and animal samples**, avoiding long-term clearing processes

### Science-industry linkages

- Support common standards in **patenting**, e.g. based on the Patent Cooperation Treaty.
- Support **mentors from industry** working on research problems in areas of joint interest public/private
- **Exchange** of professionals from industry to public research labs and students to industry
- Establish fellowships for including students in **applied private R&D**
- Encourage projects at the **interface between pure and applied science** (e.g. a concrete interface programme aiming at applying basic science to applied fields)

### Mode for selecting thematic priorities for cooperation

- **Mixed scientist-policy maker working groups** combining both top-down and bottom-up approaches in identifying topics in each region and then start dialogue with the other side (same procedure) in an India-Europe group; possible groups: SFIC, Europe Science, corresponding Indian fora
- Once this group is in place: **map clusters and centres of excellence** (in both science and industry) and categorise long- and short-term priorities
- **Open platforms** for sharing what is happening in the different countries; these platforms should also be problem solvers for the different disciplines (virtual platforms)

### Call publishing, funding modes & reporting/monitoring

- Consider a **combination of real and virtual common pot funding** (with real common funding for launching, administrating and implementing the call)
- Keep up bi-regional **monitoring and reporting**; including mid-term and ex-post evaluations
- Ensure **regular multilateral calls** within Commission-supported projects (e.g. once/year) with a variable geometry and different thematic priorities
- Keep **short the time lag between proposal submission and start of projects** (7-9 months max)
- **Optimise evaluation procedures** (without compromising on quality)
- Offer a **joint single-entry point for bi-regional research funds**, starting with a comprehensive website (offering call information) moving towards a joint programme managing agency
- Take stock of the learning effects of the existing partnerships such as ERA-NETs

### Network Setup

- Address **brain circulation** directly in programme design, allowing for flexible mobility of both junior and senior scientists

- Ensure **mutuality in exchange** and analysis of biomaterials
- **Programmes** should be **of a longer duration** (>2 years) for building sustainable cooperation
- Give support to an **increased use of virtual conferences** and e-learning infrastructure
- Encourage institutions participating in joint programmes to **provide adequate guest houses** or agreements with nearby hotels
- Allow for room/time, both at project and programme level, to build on examples and implement changes in case cooperation does not work as expected

#### **Higher education issues**

- Increase **cross-regional interaction**, e.g. between clinicians and between clinicians and basic scientists
- Encourage **joint supervision of PhDs**, acknowledging the joint character of the research done by the PhD candidate
- Offer **short-term internship training** programmes
- Support **Master-level students** doing a few months of lab internships with the scientists in the other region
- Developing infrastructure and facilities

New INDIGO has had the opportunity to present these results of its foresight study, particularly the short-term programme recommendations, during the regular session of the India Pilot Initiative of the Strategic Forum for International S&T Cooperation in Vienna on 30 November 2011. The presentation was followed by comments and a discussion with the SFIC-IPI members and contributed to contextualising and complementing the short-term programme recommendations. Additional perspectives were considered in the discussions, for instance regarding the challenges the implementation of the programme-recommendations faces in different national contexts, as well as regarding new forms of support to bi-regional collaboration (Networks/Virtual Centres of Excellence, part-time academic personnel exchange, etc.).

The results and outcomes, particularly the short-term recommendations, have also been presented to the audience of the 2nd EU-India S&T Cooperation Days in Vienna on December 1, 2011 ([www.euindiacoop.org/2011](http://www.euindiacoop.org/2011)) and are publicly available at [www.newindigo.eu/foresight](http://www.newindigo.eu/foresight).

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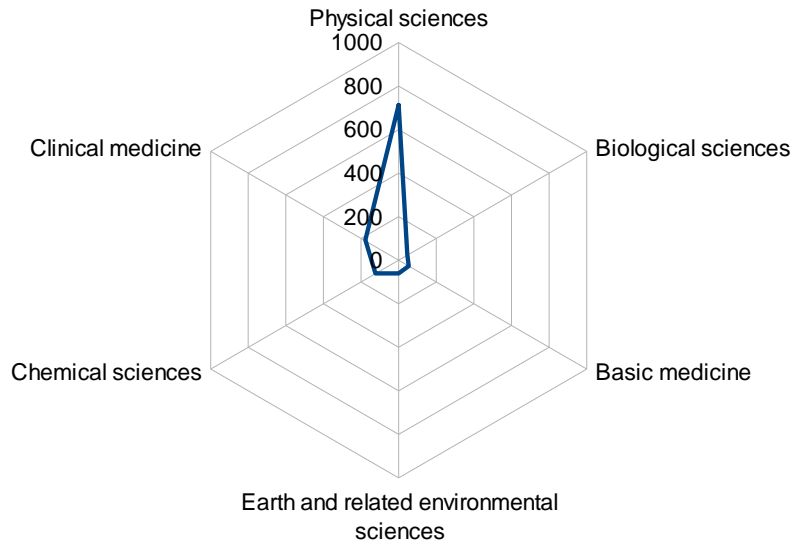
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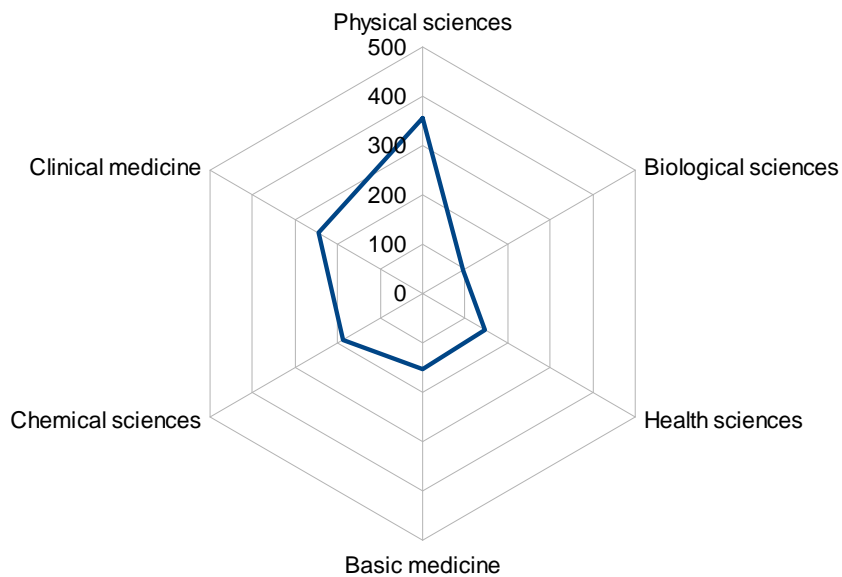
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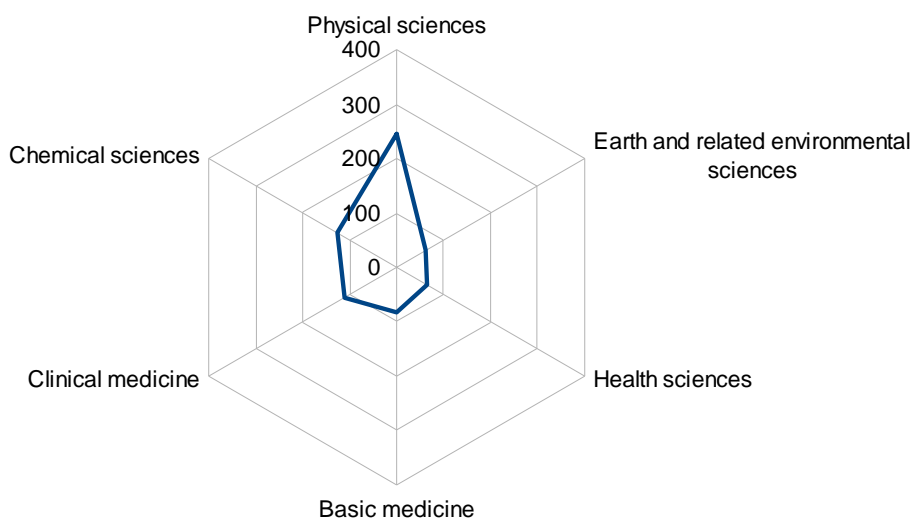
**Annex**



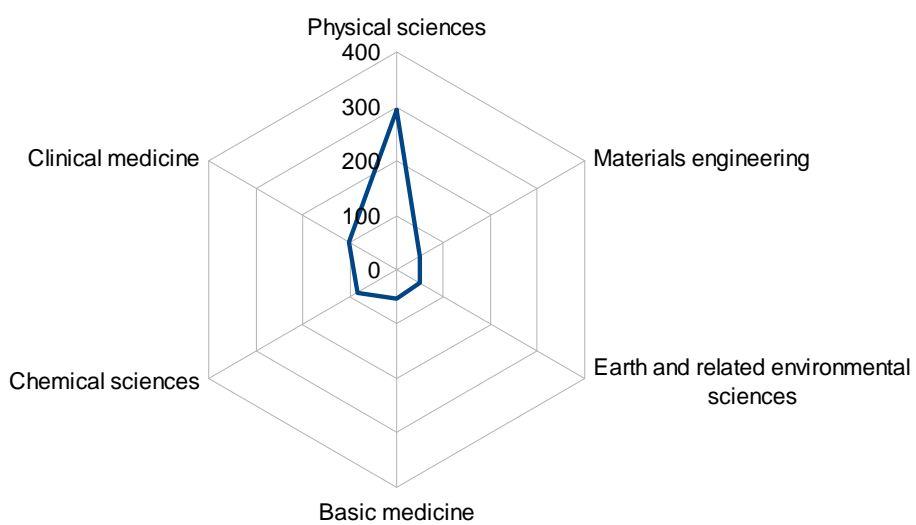
**Figure 10: Co-Publications of India with Austria**



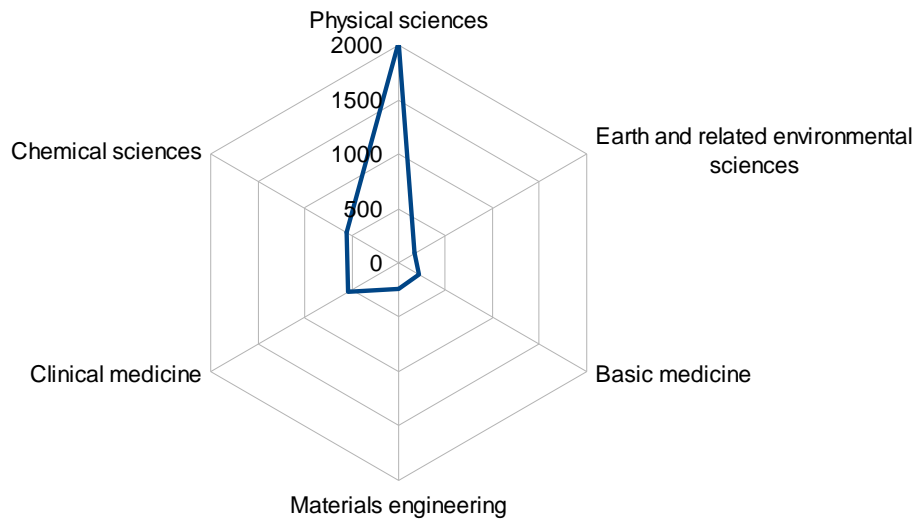
**Figure 19: Co-Publications of India with Belgium**



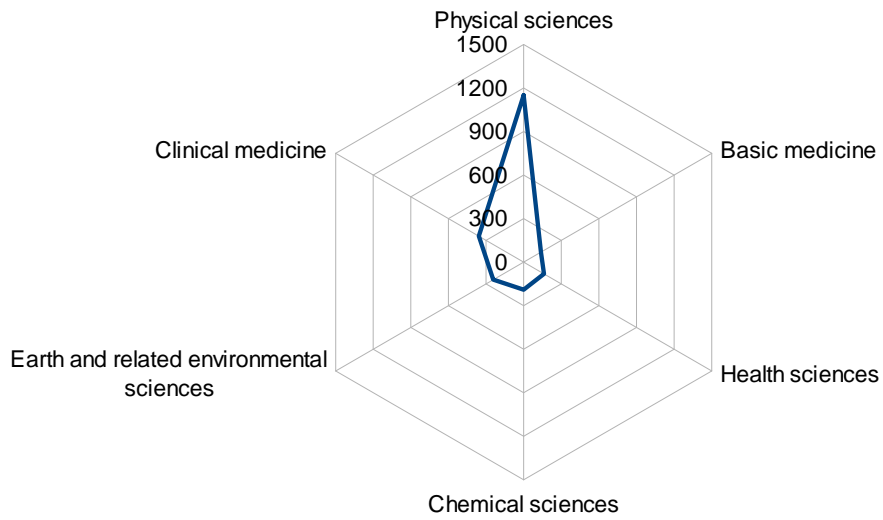
**Figure 12: Co-Publications of India with Denmark**



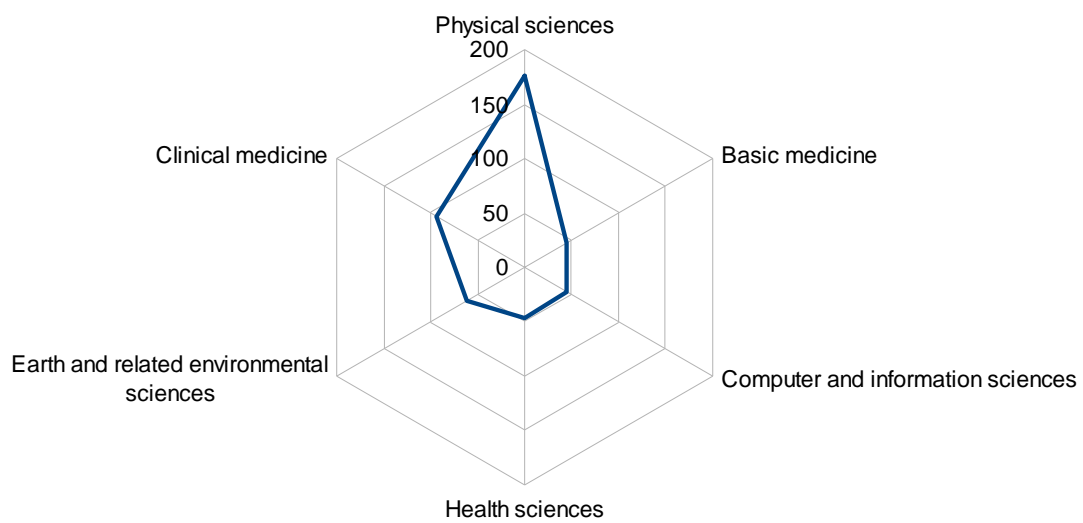
**Figure 13: Co-Publications of India with Finland**



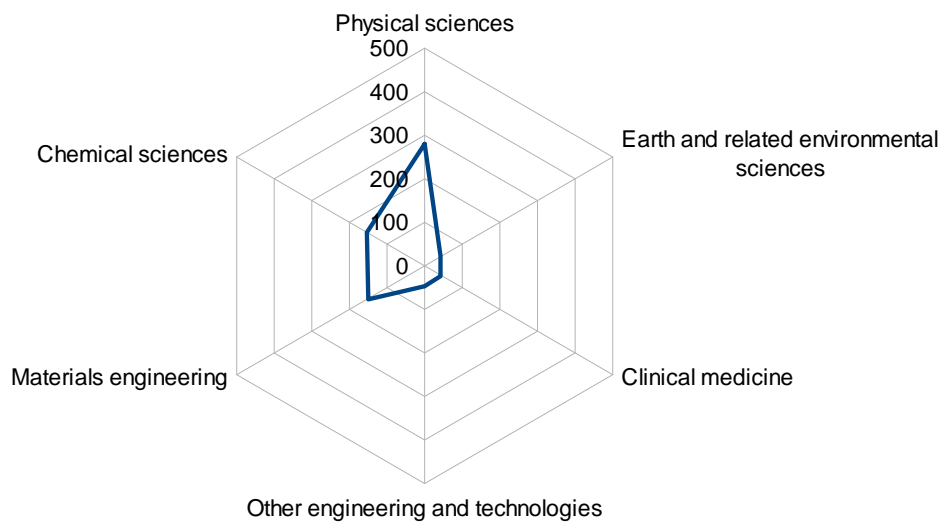
**Figure 14: Co-Publications of India with Italy**



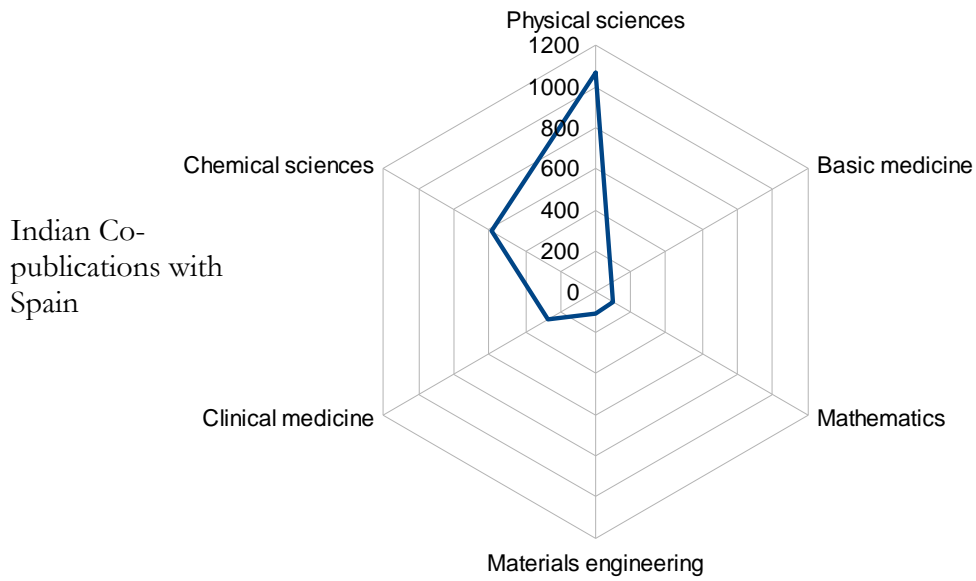
**Figure 15: Co-Publications of India with the Netherlands**



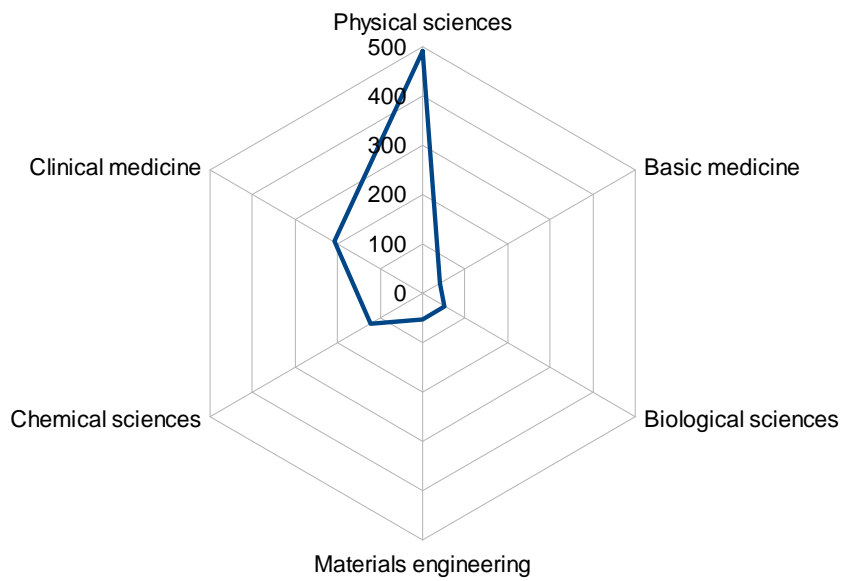
**Figure 16: Co-Publications of India with Norway**



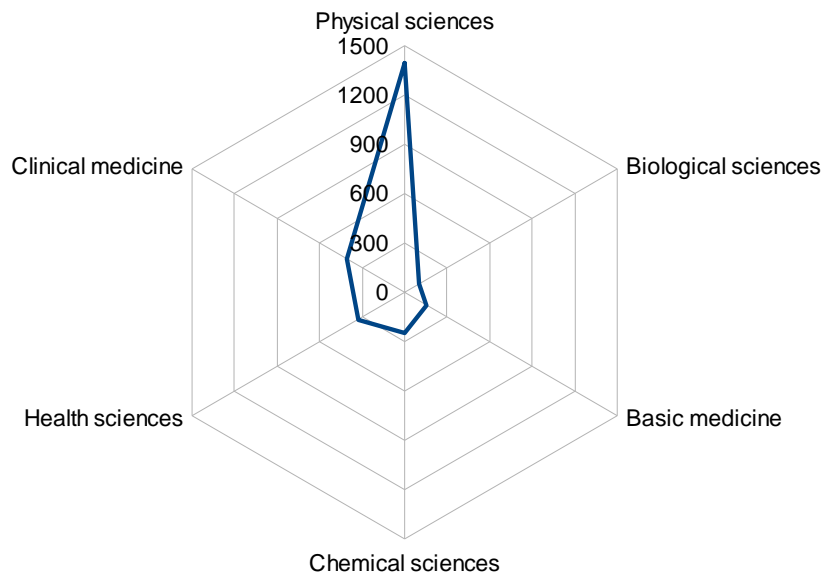
**Figure 17: Co-Publications of India with Portugal**



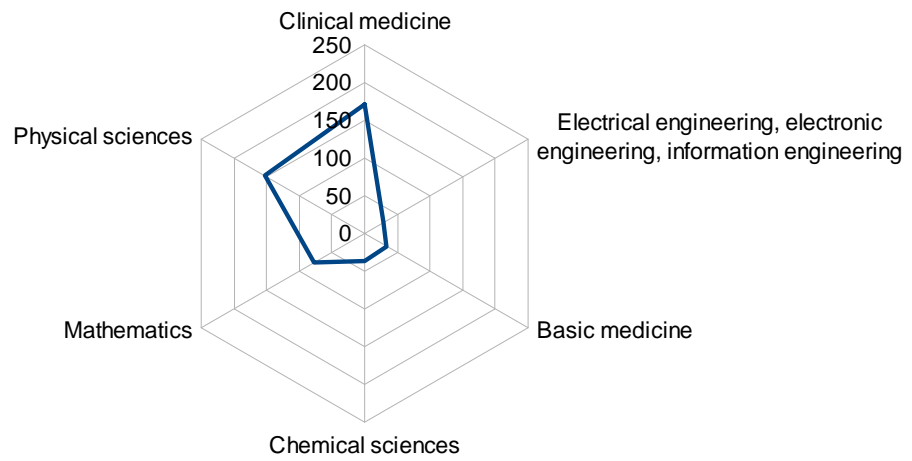
**Figure 9: Co-Publications of India with Spain**



**Figure 19: Co-Publications of India with Israel**



**Figure 11: Co-Publications of India with Switzerland**



**Figure 18: Co-Publications of India with Turkey**