Trends in R&D Cooperation among EU and BRIC countries' Higher Education Institutions

RESULTS OF THE MACRO-LEVEL ANALYSIS OF THE IP-UNILINK PROJECT

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List of Abbreviations

EU	European Union
BRIC	Brazil, Russia, India, China
HE	Higher Education
HEI(s)	Higher Education Institution(s)
PRO(s)	Public Research Organisation(s)
IP	Intellectual Property
IPR	Intellectual Property Rights
R&D	Research and Development
RTD	Research and Technology Development

1.1. Preamble

This document has been developed in the framework of the IP-Unilink project, an initiative of Higher Education Institutions (HEIs) from the European Union (EU), Brazil, Russia, India and China (BRIC countries), co-funded by the European Union within the Erasmus Mundus Programme.

The members of the project consortium are: University of Alicante (Spain) as coordinating institution, Jagiellonian University (Poland), Chalmers University Foundation (Sweden), University of Campinas (Brazil), Electrotechnical University of St. Petersburg (Russia), Kunming University of Science and Technology (China), IPR Cell of Indian Institute of Technology Roorkee (India).

The main aim of IP-Unilink is to promote EU IP management practices to facilitate research and technology development (RTD) linkages with BRIC countries. The project's specific objectives are the study of trends in Higher Education (HE) on both micro and macro levels with the objective to enhance joint research and future developments, to promote transparent compatible IP management practices, and to create a good practice guidebook for IP management and research collaboration between EU and BRIC countries.

Not only is the project idea based on the increasing importance of BRIC countries as strategic partners and associates of Europe, but also from the recommendation of official reports and studies, such as the European Research Advisory Board's[1] final report on international research co-operation in which states clearly that 'promote international co-operation in education, science and technology, and strengthen the position of Europe, the EU should deepen its ties with emerging economic and technological centers, including China, India, Russia and Brazil (BRIC countries)'. The IP-Unilink partners consider transparency and mutual understanding of IP management regimes to be the keys of successful and sustainable co-operation in research and science between EU and BRIC countries.

This document is the first output of the project and contains the findings of the Macro-Analysis that targets at studying the higher education R&D trends between the EU and BRIC countries in reagrd to improve the visibility of joint research and understand future developments.

[1] European Research Advisory Board, 'International Research Co-operation' Final Report 2006; EURAB 05.032

1.2. Objectives and Methodology

The aim of this report is to discuss trends of R&D co-operation between higher education institutions in the EU and BRIC countries, based on an analysis conducted by the IP-Unilink consortium, in order to:

I. Identify information sources on R&D and BRIC HEI co-operation,
II. Identify priorities and main sectors/areas of co-operation,
III. Identify most active partners at both country and institutional levels, and
IV. Explore IP practices in EU – BRIC projects (case studies).

According to the research framework established by the partners, all project partners collected primary and secondary information on R&D co-operation activities, mainly in the form of projects between EU and one of the BRIC countries´ higher education institutions.

The study was performed as a two-level analysis, starting with a review on secondary data sources in view of quantitative information on EU-BRIC Higher Education R&D co-operation activities, then followed by a limited secondary data collection phase with the objective of gathering qualitative information from institutions that had participated in R&D co-operation projects with these countries.

In the first phase, each BRIC country and its corresponded EU partner retrieved data from international online database which is listed individually under sources at the end of this document. Hence, this may lead to a variation of findings between the BRIC country and its corresponding EU partner.

Our BRIC country partners and their corresponded EU fellow are shown below:

University of Campanias (Brazil)	–	University of Alicante (Spain)
Electrotechnical University (Russia)	–	Jagiellonian University, IP Law Institute (Poland)
IPR Cell of Indian Institute of Technology Roorkee (India)	–	University of Alicante (Spain)
Kunming University of Science and Technology (China)	–	Chalmers University of Technology, CIT (Sweden)

This analysis leads to a non-exhaustive list of data (list of projects and agreements with details on funding, partners, duration etc.) on EU-BRIC co-operation activities, which responds to the following questions:

- What are the priority areas of R&D co-operation?
- What countries have more co-operations with each BRIC country?
- What are the most frequent areas/sectors of R&D?
- What kinds of co-operation are there?
- What are the main funding bodies and programmes for co-operation?

Furthermore, qualitative data were collected through interviews with institutions involved in EU-BRIC R&D projects. The results are presented in the form of case studies.

The data were collected between January and May 2009.

1.3. Background on BRIC R&D Policies and Cooperation with the EU

Globally, science and technology, diffusion of technological change, and world-wide access to knowledge are key drivers of economic growth and development.
BRIC (Brazil, Russia, India, and China) countries are some of the world's largest developing and transition economies and of increasing importance for Europe as strategic partners and associates. The knowledge base in BRIC countries is increasing steadily. Both, in terms of qualified human resources and investments, for example:

- In 2001 for example China, India and Russia accounted for one-third of the total global number of tertiary educated technical people
- China has increased domestic R&D expenditure by over 3.8 times between 1996 and 2003
- Most of India's recent economic growth was driven by innovations in high-technology manufacturing.

EU policymakers call for strengthening international research cooperation with BRIC countries, and steps have been taken to foster R&D cooperation on policy level, such as the signing of Science and Technology agreements and joint cooperation and R&D funding programmes.

This section presents key issues characterizing higher education and research in BRIC countries, thus providing information on the framework for cooperation and future trends.

1.3.1. BRAZIL

During the last five decades there has been a steady increase in the investment in research and development in Brazil, supported by public policies directed to foster the development of science and technology. In 1951, the National Council for Scientific and Technological Development[2] and the Financing Agency for Studies and Projects were created as part of the Ministry of Science and Technology. The former is the central organisation that sets the tone for Brazilian policy, while the latter is the lead agency to support innovation efforts within private industry, universities, and non-profits through loan and grant programmes.

In 2004, the federal Innovation Law (10.973/2004) was implemented to support partnerships between universities and the business community, and provides incentives to boost innovation and investments for public and private enterprises to share resources, raise capital and support intellectual property rights.

In 2007, an Action Plan for Science, Technology and Innovation 2007-2010[3] was launched in Brazil, aiming to strengthen the role of science, technology and innovation in sustainable development. Its goals are to increase the number of qualified human resources, investment in R&D, and enterprise innovation. Its lines of action focus on strengthening the national science and technology system; innovation; R&D in strategic areas such as biotechnology, nanotechnology, information technology, energy, climate change and the Amazon; and science and technology for social development. This national legislation to encourage innovation creates important incentives for the creation and structuring of real innovation in the Brazilian HEIs. The expansion of research and development centres contributes to the leadership of Brazil in S&T in Latin America. According to a survey conducted by the Brazilian National Council for Scientific and Technological Development (CNPQ), the number of research

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[2] Conselho Nacional de Pesquisa e Desenvolvimento, http://www.cnpq.br/
[3] Science, Technology and Innovation for National Development, Action Plan 2007-2010. http://www.mct.gov.br/upd_blob/0203/203404.pdf

institutions in Brazil grew by 5% between 2006 and 2008, reaching 422 research institutions, and the number of researchers increased 15% in that same period, with more than 100,000 researchers in the country by the end of 2008.[4]

The EU and Brazil started a framework of strategic partnership in the first EU-Brazil summit in July 2007 (the last "BRIC country" to meet the EU in a Summit). In the third and most recent summit, on 6 October 2009, both countries stressed the importance of a continued coordination between Brazil and the EU in the areas of science, technology and innovation[5]. The launch of a coordinated call on research in second generation bio-fuels under the EU FP7 on Research and Development was praised by both parties. Also, during this meeting, there were negotiations on the cooperation agreement between EUROATOM and Brazil in the field of fusion energy research. This will intensify the Brazilian participation in the Joint European Torus project[6], and will open future involvement of Brazil in large-scale European and multilateral fusion research infrastructures and projects.

There are great possibilities for the increase in research and technology development partnerships between Brazil and the EU. In fact, the EU-Brazil S&T Cooperation Agreement and the growing opportunities for international participation in EU FP7 constitute a sound basis for this to happen[7]. In addition, the boost and success in bilateral research cooperation with EU member states in the last few years, especially with France, Germany, Spain, Italy, the UK and Portugal, promises a continuation of this trend.

1.3.2. RUSSIA

The Soviet Union's S&T sector was one of the largest in the world, with many Nobel Prize recipients, a world-leading space program, and strong schools in basic sciences. When the political regime collapsed in 1991, Russia inherited this sector and implemented major cuts in the financial support for the scientific community, imposed by the economic crisis[8]. The arrival of capitalism and the process of globalization demonstrate that Russian science was not prepared to compete internationally, and a big a brain drain of scientists to other developed countries.

Today, the brain drain remains a mayor handicap for the development of sciences in Russia. In fact, on 2nd October, 2009, a hundred Russian researchers who work abroad published a letter in a leading Russian newspaper that represents an illustration of the fragile situation in Russian basic research. Among other things, they denounced that "scientists' mass departures abroad have remained a major problem for Russia."[9] According to the UNESCO World Science Report[10], "400,000 scientists left the profession between 1991 and 1995. By 2002 that figure had topped half a million"

Despite the inconsistency of funding for science during the 90s and the sudden emigration of researchers abroad, Russian science has adjusted to the current environment. Science and academic life in the country as a whole has become more open, and now welcome international cooperation in the fields of S&T. Today there are almost 4,000 organizations in the fields of science and research in Russia, which includes more than 400 universities, 1,200 state research institutions and 450 institutes of the Russian Academy of Sciences.[11]

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[4] Indicadores da Pesquisa no Brasil, http://www.cnpq.br/estatisticas/indica_brasil.htm
[5] Third European Union-Brazil Summit, Joint Statement, Stockholm, 6 October 2009. http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/er/110440.pdf
[6] The world´s largest nuclear fusion research facility, http://www.jet.efda.org
[7] http://www.internationales-buero.de/_media/CREST_WG_Brazil_Country_Report_2008.pdf
[8] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report Russia: An Analysis of EU-Russian Co-operationin S&T, http://www.internationales-buero.de/_media/CREST_WG__Russia_Country_Report_2008.pdf
[9] "Stop the Brain Drain", The Moscow News, 10 April, 2008, http://www.mnweekly.ru/national/20080410/55322506.html
[10] UNESCO Science Report 2005, The Russian Federation, http://www.unesco.org/science/psd/publications/the_russian_federation.pdf
[11] UNESCO Science Report 2005, The Russian Federation.

Recently, the Russian Prime Minister Vladimir Putin has called several times for an increase in the investment in S&T in the country, and has stressed the competitive advantages of Russia to become a world leader in nanotechnology in the near future. The Russian government has a plan to invest $10.5 billion of government funding to foster this field over the next few years until 2015.[12] This will include training of "modern, informed, qualified professionals in this field".

Russia has a long tradition of collaboration with the EU. The 1997 EU-Russia Partnership and Cooperation Agreement set, among other matters, the basis for cooperation in the areas science and technology between the EU and Russia. A specific Agreement on Cooperation in Science and Technology between the European Community and the Government of the Russian Federation was signed in 1999[13] and renewed in 2003[14].

Russia was among the most active third-countries participating in the FP6 for Research and Technological Development (2003-2006)[15], and the most successful in terms of funding support from the EU. Considering the whole FP6 (2002-2006), Russia participated in over 200 joint research projects in all thematic areas.[16]

Russia has made clear that it sees the EU as its long-term priority in S&T cooperation.[17] On 30 March 2009, there was a Council Decision regarding the positive renewal of the Agreement on Cooperation in Science and Technology between the EC and Russia.[18]

1.3.3. INDIA

Indian scientific research and technological developments since independence in 1947 have received substantial political support and most of their funding from the government. The 1958 resolution on Scientific Policy aimed to "foster, promote and sustains the cultivation of sciences and scientific research in the country and to secure for the people all the benefits that can accrue for the acquisition and application of scientific knowledge".[19] The Technology Policy Statement, January 1983[20], stated that the spirit of innovation and invention is the driving force behind all technological change, and acknowledged the importance of attaining innovation by training personnel at various levels in a wide range of disciplines. The 2003 Indian "Science and Technology Policy" promoted innovation in all aspects, and planned for the creation of a comprehensive national system of innovation covering science and technology. Among the key elements of its implementation strategy is the initiative to modernize the infrastructure for science and engineering in academic institutions.

Science and technology initiatives have been important aspects of the government's five-year plans[21] too, which intend to provide the institutional base needed to achieve long-term goals. The plan

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[12] Speech at Opening of Second Nanotechnology International Forum, Moscow, October 6, 2009 http://eng.kremlin.ru/speeches/2009/10/06/1415_type84779_222031.shtml
[13] Agreement on Cooperation in Science and Technology between the European Community and the Government of the Russian Federation, Brussels, 5 October 1999, http://ec.europa.eu/research/iscp/pdf/russia_eu_agreement_cooperation_st_en.pdf
[14] Agreement renewing the agreement on cooperation in science and technology between the Government of the Russian federation and the European Community, Rome, November 6, 2003, http://ec.europa.eu/research/iscp/pdf/russia_eu_st_cop_agreement_2003_en.pdf
[15] Communication from the Commission to the Council and the European Parliament, A Strategic Framework for International Science and Technology Cooperation, COM (2008) 588 final, Brussles, p.7
[16] http://ec.europa.eu/research/iscp/index.cfm?lg=en&pg=russia
[17] Communication from the Commission to the Council and the European Parliament, A Strategic Framework for International Science and Technology Cooperation, COM (2008) 588 final, Brussles, p.7
[18] Council Decision, 30 March 2009, Renewal of the Agreement on cooperation in science and technology between the European Community and the Government of the Russian Federation http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:092:0003:0004:EN:PDF
[19] "Scientific Policy Resolution 1958", http://dst.gov.in/stsysindia/spr1958.htm
[20] "Technology Policy Statement, 1983", http://dst.gov.in/stsysindia/sps1983.htm
[21] The economy of India is based in part on planning through its five-year plans, developed, executed and monitored by the Planning Commission.

currently in place is the 2007-2012 Eleventh Five Year Plan. It increases central allocations for higher and technical education compared to the 10th plan. Seven new Indian Institutes of Technology, six new Indian Institutes of Management, and 30 new central universities have been provided for. [22]

In terms of S&T collaboration between the EU and Indian HEIs, there has been a remarkably increase during the last 10 years, boosted by a comprehensive Science and Technology Cooperation Agreement signed in 2002, that promoted closer participation of universities, research organizations and other institutes and entities in S&T in each other's research projects. [23] This agreement was renewed during the India-EU Ministerial Conference on Science, in New Delhi on 7th and 8th February 2007[24]. As a result, India has become an important partner in EU research framework programmes, with a rapid growth in cooperation between European and Indian HEIs during the FP5 and FP programme (although the number of collaborations is the smallest compared to the other BRIC countries). [25] Indian organizations have also been active in FP7, which started on January 1st, 2007.

Today, EU and Indian HEIs have established long term partnerships, both multilaterally and bilaterally, that produced high quality research projects. In the future, it is expected that this research will be focused on climate change, energy and human health. Also, the Researchers´ Visa Scheme, which reduces barriers to movement within the EU of researchers who are not nationals of any of it member states, predicts a substantial increase in the exchange of researchers between EU and India.[26]

1.3.4. CHINA

Since the 1980s, China has produced extensive legislation in S&T; among them are the Science and Technology Progress Law (1993), the Patent Law (1992), and the Technological Contract Law (1987). In addition to laws and regulations, many policies and measures on research, science and technology have been issued in the last few years. Such legislations could be generally classified into three types: regulations on management and protection of IP, regulations on awards for innovative technology, and regulations on project management of research and innovation. In an effort to gain competitiveness in research, the Chinese government undertook a series of incremental reforms to bridge the gap between research and the industry, decreasing "government budget for applied R&D institutions gradually so as to force them to survive in the market, and to encourage R&D institutions and university to exploit the economic value of S&T research by setting up their own companies"[27]. In 1999, the State Science and Technology Commission became the Ministry of Science and Technology, which constituted a "departure from a structure common in centrally planned economies to one more usual in Western countries"[28] That same year, China took another reform measure and started the conversion of 242 R&D government-owned research institutes into enterprises, in an effort to build the national innovation system up.

In the last decade Chinese Universities have gained significance as centres for the generation of knowledge, diffusion and technological innovation, accounting for 17.5% of total R&D personnel and 10.1% of total R&D expenditure. However, research institutions and, especially, large and medium-sized enterprises are the principal engines for innovation in China. The public and private sector have steadily created mechanisms for cooperation between the HEIs and enterprises. It is estimated that "80% of large enterprises have established cooperation partnerships with universities and research institutes."[29]

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[22] "Indian Higher Education: Time for a Serious Rethink", International Higher Education, Boston College, Number 56 summer 2009.
[23] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report India: An Analysis of EU-Indian Co-operationin S&T, p.23
[24] http://www.delind.ec.europa.eu/kp-st-overview.asp?links=st-link1,
[25] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report India: An Analysis of EU-Indian Co-operationin S&T, p.23
[26] India-EU Ministerial Science Conference: The New Delhi Communiqué - http://ec.europa.eu/research/iscp/pdf/new_delhi_communique_signed_en.pdf
[27] Evaluation of Science and Technology Policy in China, 2004 http://www.nistep.go.jp/IC/ic040913/pdf/30_04ftx.pdf
[28] UNESCO Science Report 2005, The , http://www.unesco.org/science/psd/publications/east_and_south-east_asia.pdf;
[29] Evaluation of Science and Technology Policy in China, 2004.

The first Agreement for Scientific and Technological Cooperation between the European Community and the Government of the People's Republic of China was signed in 2000, and aimed to "establish a formal basis for cooperation in scientific and technological research which will extend and strengthen the conduct of cooperative activities in areas of common interest and encourage the application of the results of such cooperation to their economic and social benefit"[30]

Subsequent agreements and joint declarations have included sections and decisions on the key role that investment in R&D have on sustainable economic growth, and have called for an increase in research collaboration between the EU and China. In fact, in the FP6, China was one the largest third country partners with 134 joint research projects and 260 Chinese partners. [31] However, in spite of the continuous growth in S&T development and participation in Framework Programme, more cooperation with EU and involvement in FP should not be ignored.[32]

The cooperation programme between EU and China is an important mechanism for underpinning their partnership based on political dialogue and economic, trade and sectoral relations. It has illustrated that three areas of co-operation have been emphasizing: (1) environment, energy and climate change; (2) engineering; (3) human resources development, governance, and capacity building, especially in the field of higher education, finance service and public administration co-operation. It is expected an increase in this collaboration; FP7 further intensifies the S&T cooperative relationship between these partners. [33]

[30] The first Agreement for Scientific and Technological Cooperation between the European Community and the Government of the People's Republic of China, 11/01/2000, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:006:0040:0045:EN:PDF

[31] http://ec.europa.eu/research/iscp/index.cfm?lg=en&pg=china

[32] Horvat, Manfred and Lundin, Nannan, Review of the Science and Technolog Cooperation between the European Community and the Government of the People´s Republic of China, p.41

[33] Horvat, Manfred and Lundin, Nannan, Review of the Science and Technolog Cooperation between the European Community and the Government of the People´s Republic of China, p.5

2. ANALYSIS OF COOPERATION - BRIC COUNTRY

This section illustrates the findings and results of the study conducted by the IP-Unilink consortium on cooperation activities among EU and BRIC country with participation of Higher Education Institutions. For each BRIC country, the following areas are discussed:

- Methodology
- Drives of co-operation and agreements
- Most active players
- Main areas of co-operation
- Sources of funding
- Common forms and duration of co-operation

The sequence follows the acronym **BRIC**, i.e. **B**razil, **R**ussia, **I**ndia and **C**hina:

2.1. BRAZIL

2.1.1. METHODOLOGY

This section offers a non-exhaustive overview of the existing Science, Technology and Innovation cooperation initiatives between Brazil and the European Community, as well as opportunities for future collaboration.

Data were collected from various sources, including the CORDIS databases for projects, as well as information from relevant governmental bodies in Brazil for cooperation agreements (a list of sources is presented in Annex I). More than 260 co-operation initiatives were reviewed, varying from broader co-operation agreements to projects between HEIs.

In the search for cooperation agreements carried out by the more active science and technology Brazilian institutions, the case of the University of Campinas stood out with around 130 agreements with different European institutions. This HEI was also selected as one of the cases studies that illustrate an example of successful collaboration in a research project involving an EU and a Brazilian partner.

2.1.2. DRIVES OF CO-OPERATION & AGREEMENTS

I. Political Relations and Agreements:

Having established diplomatic relations in 1960, the present relationship between EU and Brazil is governed by the EC-Brazil framework co-operation agreement (1992), EU-Mercosur Framework Co-operation Agreement (1995) and the **Agreement for Scientific and Technological Co-operation (2004)** [34]

Science and technology in general is a central dimension of EU – Brazil cooperation.
The new possibilities for international participation in the EU's Seventh Research Framework Programme (FP7), running from 2007 to 2013, provide a sound basis for increasing existing cooperation and improving participation by Brazilian HEIs and scientists in FP research projects and fellowships. In

[34] Brazil-European Union Strategic Partnership – Joint Action Plan, 2nd Brazil - European Union Summit, Rio de Janeiro, 22 December 2008, http://ec.europa.eu/external_relations/brazil/index_en.htm

addition, a series of "Specific International Co-operation Actions" (SICA) aims to foster international cooperation with Brazil and jointly address problems of shared concern.

II. Programmes promoting co-operation

Several other EU Member States have cooperation programmes with Brazil. The following table shows various programmes that are available for institutions and researchers from EU and Brazil to cooperate with each other at three different levels: European Union level, EU Member States level and the BRIC country level, i.e. Brazil.

LEVEL		PROGRAMMES	
European Union		- Framework Programmes: FP6, FP7 - ALFA - EuroSociAL, - @lis - AL-Invest - URB-AL - Erasmus Mundus	
EU Member States	**Germany**	Science and Technology for the Mata Atlântica [35]	It boosts the conservation and improves the management of the Brazilian Atlantic forest
	France	CIRAD[36]	French agricultural research centre that carries many co-operation in agriculture and environment with Brazil.
	United Kingdom	UK-Brazil Partnership in Science and Innovation [37]	It facilitates universities, research institutes and companies from both countries to establish partnership
	The Netherlands	Programma Nuffic – CAPES [38]	It provides opportunities for collaboration between the HEIs in both countries, co-funded the Nuffic and CAPES.
BRIC Country- BRAZIL	**Programa de Cooperação Temática em Matéria de Ciencia e Tecnología - PROÁFRICA[39]**	It provides financial support to cooperation activities in joint science and technological innovation projects and events with Portuguese-speaking African countries: Angola, Cape Verde and Mozambique.	
	Programma Nuffic – CAPES [40]	It provides opportunities for collaboration between the HEIs in both countries, co-funded by the Nuffic and CAPES.	

[35] Federal Foreign Office - http://www.auswaertiges-amt.de/diplo/en/Laenderinformationen/01-Laender/Brasilien.html
[36] CIRAD - http://www.cirad.fr/en/le_cirad/cirad_monde/pays.php?id=209
[37] UK-Brazil Science and Innovation - http://www.reinounidopelaciencia.com.br/parceria/en/index.html
[38] Nuffic - http://www.nesobrazil.org/dutch-organizations/programma-nuffic-capes/programma-nuffic-capes
[39] Federal Foreign Office - http://www.auswaertiges-amt.de/diplo/en/Laenderinformationen/01-Laender/Brasilien.html
[40] Nuffic - http://www.nesobrazil.org/dutch-organizations/programma-nuffic-capes/programma-nuffic-capes

Table1: Programmes available for EU-Brazil cooperation

It is remarkable that Brazil is one of the countries with the highest participation and success rates in the Erasmus Mundus[41] programme.

III. Priorities for Research and International Co-operation

The priority areas of the European Unión for cooperation with Brazil**,** according to the Joint Action Plan are: [42]

- social sciences and humanities
- e-infrastructure
- energy
- cross-sectional studies
- training and development of human resources
- researcher exchanges
- environment and climate change
- nanotechnology and materials
- health
- safety
- information and communication technologies,
- transport
- food
- agriculture, fisheries
- biotechnology.

According to the Brazilian Ministry of External Relations, the current prioritized research areas in Brazil are:

- Information and Communication Technology
- Engineering
- Physics and Mathematics
- Nanotechnology
- Biotechnology
- Health
- Social Sciences
- Amazonia
- Antarctic and Sea
- Biodiversity and Environment
- Agribusiness
- Energy and Nuclear Energy.

More specifically, the emphasis of Brazilian foreign policy in science and technology has been focused on:

1) The high tech areas, which are propitious to technological transformation, such as computers (including telecommunications and automation), biotechnology, new materials, spatial technology and precision engineering.
2) Improving those technologies with direct social impact, such as education, public health, basic sanitation, urban and regional development, civil safety, foodstuffs, nutrition, environment, energy and transportation.

[41] European Commission, Brazil Country Strategy Paper 2007-2013; 14.05.2007 (E/2007/889)

[42] Brazil- European Union Strategic Partnership – Joint Action Plan; 2nd Brazil - European Union Summit, Rio de Janeiro, 22 December 2008

As for the **alternative and renewable energy** issue, Brazil contributes remarkably to the discussion, since it has accumulated important know-how in the biofuels area, particularly regarding to the use of ethanol produced from sugar cane as an automotive fuel.

2.1.3. MOST ACTIVE PLAYERS IN EU-BRAZIL CO-OPERATION

I. Countries

A review of EU financed projects that include a Brazilian partner, using the CORDIS[43] database, revealed the following countries as the most active when it comes to research cooperation with Brazil:

COUNTRY	NUMBER OF PROJECTS
France	61
United Kingdom	60
Germany	45
Spain	36
Italy	28
Belgium	20
Netherlands	14
Portugal	10

Table 2: EU Financed Projects with Brazilian Participation

Similarly, 134 agreements and cooperative projects between Brazil and European nations were compiled from websites and databases of Brazilian ministries and government research and funding institutions. The analysis of these data showed that the main European partners of Brazil in the areas of Science and Technology are the following:

COUNTRY	NUMBER OF AGREEMENTS
France	31
Germany	26
United Kingdom	12
Italy	9
Spain	8
Portugal	7

Table 3: S&T Cooperation Agreements between EU Countries and Brazil

Finally, the case of the University of Campinas was studied, as it is one of the most active Brazilian HEI at international cooperation initiatives. A collection of 129 international agreements (mainly at exchange of staff) was retrieved, not considering the informal cooperation projects established between Brazilian and European research groups. The top European players in these agreements were:

COUNTRY	NUMBER OF AGREEMENTS
France	45
Spain	23
Italy	20
Portugal	14
Germany	12

Table 4: S&T Cooperation Agreements between European Countries and the University of Campinas

[43] http://cordis.europa.eu/search/index.cfm?fuseaction=proj.advSearch

Regardless the analysis and data employed, the results shown in these tables highlight France as the most enthusiastic EU country in research partnerships with Brazil, followed by Germany, the United Kingdom, Spain, Italy and Portugal.

II. Institutions

At the institutional level, the co-operation initiatives with Brazil analysed were dispersed among the various European institutions (including both, HEI and funding bodies). Nevertheless, there is a clear predominance of some institutions/programs in France, Germany and Spain, as shown in the following table:

COUNTRY	INSTITUTION
France	**MAE** - Ministère des Affaires Etrangères
	CNES - Centre Nationale D'Etudes Spatiales
	CNRS - Centre National de la Recherche Scientifique
	INSERM - Institut National de la Santé et de la Recherche Médicale
	INRIA - Institut National de Recherche en Informatique et en Automatique
Germany	**DAAD** – Deutscher Akademischer Austausch Dienst
Spain	**CYTED** – Programa Ibero-Americano de Ciencia y Tecnología para el Desarrollo

Table 5: Most Active European Institutions in Cooperation Initiatives with Brazil

With respect to the most active Brazilian ministries and government research and funding institutions in science and technology agreements with the EU, they are:

INSTITUTION
MRE - Ministry of External Relations (broader agreements)
CAPES - Brazilian Federal Agency for Support and Evaluation of Graduate Education
INPE - National Institute For Space Research
CNPq - National Counsel of Technological and Scientific Development
FAPESP - São Paulo State Foundation for the Promotion of Research
MCT – Ministry of Science and Technology
MMA – Ministry of the Environment

Table 6: Most Active Brazilian Institutions in S&T Agreements with the EU

The analysis of the EU funded research projects registered in the CORDIS database indicates that a wide range of European and Brazilian Higher Education Institutions were engaged in joint projects. The most active among the Brazilian HEIs were found to be:

BRAZILIAN HEI	PARTICIPATION IN EU FUNDED PROJECTS
Oswald Cruz Foundation	14
Federal University of Santa Catarina	14
University of Sao Paulo	13
University of Campinas	9
Federal University of Rio de Janeiro	8
Federal University of Pernambuco	5

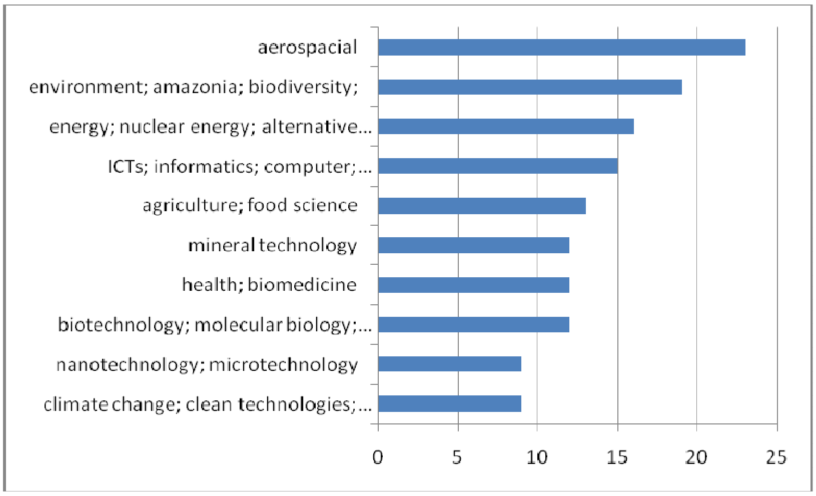
Table 7: Most Active Brazilian HEIs in EU Funded Projects

2.1.4. MAIN AREAS AND TYPES OF CO-OPERATION

I. Main Areas of Cooperation

Considering the projects and agreements of cooperation analysed within this study, the following areas were identified as the most common in the co-operation agreements established between Brazil and countries from the EC, they are listed in order of importance:

- Aerospace technology
- Environment: sustainable development, the Amazonia and biodiversity
- Energy: nuclear energy, alternative energy, biofuels and bioethanol
- Information and Communication Technology (ICT): informatics, computer and bioinformatics
- Agriculture and food science
- Mineral technology
- Health: medicine and biomedicine
- Biotechnology, molecular biology and microbiology
- Nanotechnology and micro technology
- Climate change, clean technologies and pollution



Graph 1: Most common scientific areas of cooperation

Moreover, by analysing broader co-operation agreements between Brazil and Europe, some areas of collaboration appear more frequently with some specific countries. Some examples of these prior areas of cooperation are listed below:

- Between **Brazil and Germany**:

Aeronautics; Aerospace technology; Environment; Climate change; Marine resources ; Agriculture; Food safety ; Food science ; Biotechnology; Nanotechnology; Health; Virology; Sustainability; Energy.

- Between **Brazil and the United Kingdom**:

Health; Biotechnology; Nanotechnology; Biomaterials; Agriculture; Genetics; Food technology; Pest control; Bioinformatics; Climate change; Energy; Sustainability; Materials engineering; Foresight/ horizon scanning.

- Between **Brazil and Spain**:

ICTs, Nanotechnology, Biomedicine; Molecular Biology; Health; Medicine; Biotechnology; Energy; Biofuels; Agriculture; Hydrogeology; Aerospace Technology.

II. <u>Common types of co-operation</u>

As for the types of cooperation established between Brazil and the EU countries, the sample analyzed reveals the following:

- general (long term) cooperation agreements / broader cooperation agreements
- exchange of faculty/staff/students
- projects (short-term with specific objectives)
- infra-structure

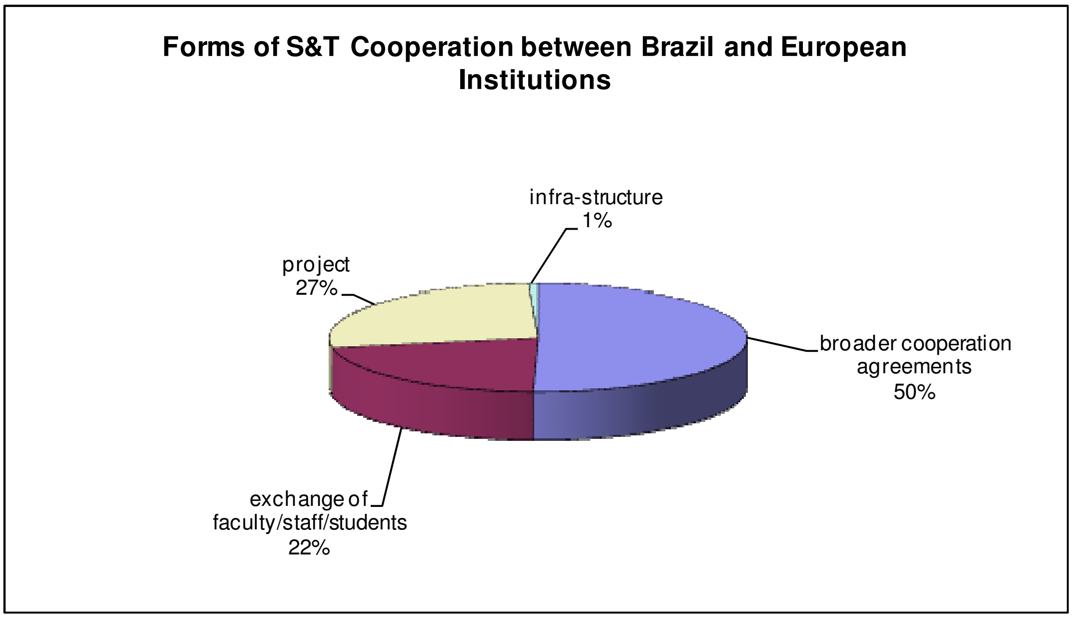


Table 8: Common types of EU-Brazil S&T cooperation

2.1.5. SOURCES OF FUNDING

The following European and Brazilian funding institutions frequently appeared as partners in S&T co-operation initiatives between Brazil and the EC:

I. <u>Brazilian Institutions:</u>

- MCT (Ministry of Science and Technology /Ministério da Ciência e Tecnologia)
- CNPq (National Counsel of Technological and Scientific Development/Conselho Nacional de Desenvolvimento Científico e Tecnológico)
- Finep (Brazilian Innovation Agency/Financiadora de Estudos e Projetos)
- MEC (Ministry of Education/Ministério da Educação)
- CAPES (Brazilian Federal Agency for Support and Evaluation of Graduate Education /Coordenação de Aperfeiçoamento de Pessoal de Nível Superior)
- FAPESP (São Paulo State Foundation for the Promotion of Research/Fundação de Amparo à Pesquisa do Estado de São Paulo)

II. **European Institutions:**

Germany

- DAAD (German Academic Exchange Service/Deutscher Akademischer Austausch Dienst)
- Alexander von Humboldt Foundation (Alexander von Humboldt-Stiftung)
- DFG (German Research Foundation / Deutsche Forschungsgemeinschaft)

France

- COFECUB (French Evaluation Committee of the Academic Co-operation with Brazil/Comité Français d'Evaluation de la Coopération Universitaire et Scientifique avec le Brésil)
- CIRAD (Agricultural Research Centre for International Development/ Centre de Coopération Internationale en Recherche Agronomique pour le Développement)
- CNRS (National Center for Scientific Research/Centre National de la Recherche Scientifique)
- INRA (National Institute for Agricultural Research/Institut National de la Recherche Agronomique)
- INRIA (National Institute for Research in Computer Science and Control/Institut National de Recherche en Informatique et en Automatique)
- Inserm (National Institute for Health and Medical Research/Institut National de la Santé et de la Recherche Médicale)

Portugal

- ADI (Portuguese Innovation Agency/Agência de Inovação)

United Kingdom

- Engineering & Physical Sciences Research Council
- British Council

Spain

- Fundación Carolina (Carolina Foundation) - CEALCI (Centro de Estudios para América Latina y la Cooperación Internacional)
- CYTED (Iberoamerican Developement Programm for Science and Technology/Programa Ibero-Americano de Ciencia y Tecnología para el Desarrollo)

III. **Multi country:**

European Union:

- Framework Programmes: FP6, FP7
- ALFA
- EuroSociAL,
- @lis
- AL-Invest
- URB-AL
- Erasmus Mundus

The United Nations:

- UNDP (United Nations Development Programme)
- UNEP (United Nations Environment Programme)

The World Bank:

- BIRD (Banco Internacional para Reconstrução e Desenvolvimento)

2.1.6. CASE STUDIES' MAIN FINDINGS

In order to learn more about the particularities of R&D cooperation among EU and Brazilian Higher Education Institutions, some specific projects were selected and interviews conducted. The following tables summarise the main findings from these case studies. The complete case studies can be found in section 4.1 of this report:

I. Case Study on the MAIZE FOR ACID SOILS project

PROJECT	**Maize for Sustainable Cropping Systems on Tropical Acid Soils - from Molecular Biology to field cultivation**
DURATION	36 months (01/11/00- 31/10/03)
PROGRAMME	Fifth Framework Programme; Project Reference: ICA4-CT-2000-30017
OBJECTIVE	To understand and improve the responses of plants exposed to acid soils and aluminum toxic levels. To bring benefits to smaller scale farmers and enable agricultural frontier expansion in maize producing countries.
PARTNERS	• One Brazilian university • One Brazilian company • Two Latin-American research centres • One African research institute • Two EU universities • Three EU research centres and institutes
PROJECT INITIATION	• Initial contact between Professor Pere Puigdomenech from Spain and Professor Water Horst from the Hanover University. • Professor Marcelo Menossi, a researcher from the State University of Campinas (UNICAMP), was supervised by Mr. Puigdomenech.
IPR ISSUES	The IPR issues were all described in the Annex II of the contract, effective for all partners on the day after the signature, including: • Clear and well defined rules regarding the knowledge ownership protection and enhancement • General principles for access rights • Access rights for exploitation and their conditions • Refusal to granting of access rights for exploration • Technological implementation plan • Content of technological implementation plan • Project and knowledge advertising and communication • Reliability • Communication of data for evaluation and standardization • Incompatible or restrictive compromise
HINDERS	• Difficulties in obtaining institutional information from the Brazilian partners: the EU required a large amount of detailed information. • Difficulties in shipping biological samples from countries to countries: countries´ institutional regulations (as authorization from agencies for samples transference) and customs problems (disabled the material when arrived at its destination).
SUPPORTS	Extra attention paid to each phase of the project helped overcome the difficulties. Besides that, all veteran researchers further smoothed the development.
FUTURE COOPERATION	According to **Brazilian partners**, "there will be a tendency to reduce the cooperation between the Brazilian and the European high education institutions in the near future" due to: • Increase in Brazilian internal resources for research. • The number of researchers in Brazil is steady and the amount of attributions for the same ones has only increased, thus leaving little time for larger projects. • The development of internal research nets in Brazil makes the need of international cooperation less essential. To increase future cooperation's between Brazil and the EU, the ideal would be the development of joint research proclamations for new research.

Table 9: Case study on the MAIZE FOR ACID SOILS project

II. Case Study on the GENEO-TROPECO project

PROJECT	**Sustainable management of Neo-Tropical Tree Genetic Resources: Combining molecular and modelling methods to understand structure and dynamics of gene diversity**
DURATION	48 months (01/02/02- 31/01/06)
PROGRAMME	Fifth Framework Programme; Project Reference: ICA4-CT-2001-10101
OBJECTIVE	To study the influence that life history and ecological traits have on the structuring of genetic variation for a range of forest tree species from across the Neotropics.
PARTNERS	• One Brazilian university • One Brazilian research institute • One Costa Rican • One EU university • Two EU research centres and institutes
PROJECT INITIATION	• Some European partners had been cooperating with Brazilian researchers since 1989. • The partners worked in two previous EU funded collaborative projects. • The planning and first draft of the proposal for the GENEO-TROPECO project was initiated in the last meeting of a previous project.
IPR ISSUES	• The partners signed an EU standard contract model that was, in essence a research plan. An IP agreement was not considered necessary at that time. • To ensure that correct procedures were followed in the export and use of sampled tissue material, the text of a *"Material Transfer Agreement for Research-Only Purposes*" was drawn up and agreed between partners later on. • There were no patentable results from this project, and all of the research outcomes were made public via the usual academic routes. • The subsequent EU funded project (SEEDSOURCE) was formalized in 2005 as a consortium agreement and included provisions on confidentiality and IP rights. <u>Partners' views on IP issues:</u> • Common believe that increased awareness of IP issues can enhance cooperation with any country. • European partners: there is extensive knowledge of handling IP issues in Brazil. All the Material Transfer Agreements and some of the IP provisions in the SEEDSOURCE project were created *"crafted to the Brazilian demands and requirements. The initiative came from the Brazilian partners.*" • Research collaboration with Brazil would be enhanced by well-defined IP and confidentially agreements. • IP is being taken more and more seriously by everybody in the administration and in the research community. • Some guidelines on the partners' rights and responsibilities regarding IP should be drafted, but "*they should not be too strict to be able to cover any potential outcome"*.
HINDERS	• Restrictions on the exchange of samples caused delays in the project. • Samples not sent as promised by Brazilian counterparts had a negative effect on the project. • The schedule of payments by the EU caused additional delays in the project´s activities.
SUPPORTS	• Managerially, the consortium partners worked extremely well together. • Fluent and frequent communication. • Full attendance to annual meetings and the share of human resources and ideas maintained an atmosphere of positive interaction. • Partners were reliable, shared the same interests, and welcomed collaboration. • The project originated additional professional relationships between senior and junior researchers for future collaboration.

FUTURE COOPERATION	• The GENEO-TROPECO project's partners plus one Ecuadorian university and three more European institutes applied and received 1699999 Euros under FP6 for the subsequent SEEDSOURCE project. It started in May 2005 and will last until the end of January 2010.
	• In the 2010 annual coordination meeting of SEEDSOURCE the partners will initiate discussions for a new project.
	• In 2009 there are no calls for projects on biodiversity in Latin America, but they are expecting that this will come up in 2010.
	<u>Trends:</u>
	• The current worldwide economic crisis may affect future international research collaboration in terms of funding.
	• **Brazilian researchers' view:**
	    o Expect an increase in bilateral collaboration between Brazil and European countries. Brazilian researchers are very interested in building relationships and engaging in joint research with U.S. institutions too.
	    o In Brazil there are two approaches towards research:
	        ▪ Scientists who want to engage in discussions at the international level
	        ▪ Researchers that collaborate primarily to get funds ("when they are running low on cash.")
	• **European partners' view:**
	    o With the major change in the EU funding model, there will be problems to organise collaboration projects between Brazil and the EU. FP 7 integrates international science and technology collaboration throughout the Framework Programme. Financially, "international cooperation has dramatically decreased in favour of EU projects. Mainstream funds focus on EU questions. It is getting more and more difficult to find common questions that are appropriate for Europe and Brazil."
	    o The strength of the research community in Brazil presents a barrier to build international research agreements with scientists from that country. Brazil has well-equipped labs, highly qualified human resources and biodiversity and, sometimes, "they are so confident that it seems they do not need any collaboration from abroad." Brazilian researchers have "very strong projects of their own."

Table 10: Case study on the GENEO-TROPECO project

2.2. RUSSIA

2.2.1. METHODOLOGY

According to a preliminary analysis of cooperation activities among HEIs from EU and Russia, the number of projects meeting the formal criteria is very large. It was, therefore, necessary to limit the scope of some criteria in order to be able to construct a visible and useful overview. As far as the area of activity is concerned, special attention has been paid to co-operation areas such as: industry, environment protection, medicine. The range of Russian HEI's has been limited mainly to universities or research institutes of Russian Academy of Science.

Data were collected on CORDIS database. In total 200 co-operation initiatives were found, and 40 current projects were analysed in more detail.

2.2.2. DRIVES OF CO-OPERATION AND AGREEMENTS

I. Political Relations and Agreements

Apart from the fact that Russia 'has made it clear that it sees the EU as its long-term priority in S&T co-operation'[44], its participation of the Bologna process would also lead to considerable numbers of S&T exchanges and co-operation, and its debut implementation of common space of education and research with Europe, which was highlighted in the 'Strategy for the development of Science and Innovation in the Russian Federation in the period until 2015'. Alternate forms of cooperation in FP7 were also discussed in the Strategy. [45]

Russia is a prior cooperation partner for Europe in the Science & Technology field, alongside the countries like U.S., China, Japan, Canada and Australia.

The most important documents regulating EU-Russia co-operation are:

- EU-Russia Partnership & Co-operation Agreement,
- EC-Russia S&T Co-operation Agreement,
- Euratom-Russia Co-operation Agreement in Nuclear Fusion,
- The Northern Dimension Environmental Partnership (NDEP)
- Euratom-Russia Co-operation Agreement in Nuclear Safety,
- Road-map for the Common EU-Russia Space in Research, Education & Culture.

Currently there is no legal basis for specific R&D co-operation, due to the fact that the Agreement on cooperation in science and technology between the European Community and the Government of the Russian Federation in 2000 expired on 20th February 2009. Concluding/renewing appropriate treaty is still under negotiations[46].

[44] Communication from the Commission to the Council and the European Parliament, A Strategic Framework for International Science and Technology Cooperation, COM (2008) 588 final, Brussles, p.7
[45] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report Russia: An Analysis of EU-Russian Co-operationin S&T, p.16
[46] European Commission Treaties Office Database - http://ec.europa.eu/world/agreements/searchByCountryAndContinent.do?countryId=3853&countryName=Russia

In Higher Education, Russia is participating in the Bologna process and adapting its educational system to European system. This will certainly facilitate further exchanges and cooperation in S&T and confirms the priority Russia has laid on cooperation with Europe.[47]

II. Programmes promoting co-operation

Russia also participated actively in previous **EU Framework Programmes** and became the most successful "third-country" in FP6: Approximately 330 FP6 contracts were signed with partners from Russia, including 60 **Marie Curie** fellowships, worth around €2.8 billion. Total EC contribution to RU participants in FP6 was some €120 million[48].

Currently, Russia actively participates in the FP7 Programme as an International Co-operation Partner Country (ICPC)[49]. Moreover, coordinated EC-Russia calls are being launched, where the EC and Russia jointly define specific topics, and the Russian participants in selected projects will then be funded by the Russian Federal Agency for Science and Innovation (FASI).

Additionally, Russia has shown its enthusiasm in several international initiatives in the field of technology and science, such ISTC – International Science & Technology Centre; ITER - International Thermonuclear Experimental Reactor; CERN - the world's largest particle physics centre.

Most EU Member States have cooperation programmes and a large majority of countries has underpinned the cooperation with Russia with a formalised S&T cooperation agreement.

The following table shows various programmes that are available for institutions and researchers from EU and Russia to cooperate with each other at three different levels: European Union level, EU Member States level and the BRIC country level, i.e. Russia:

<table>
<tr><th colspan="2">LEVEL</th><th colspan="2">PROGRAMMES</th></tr>
<tr><td colspan="2">European Union</td><td colspan="2">- Framework Programmes
- INTERREG
- EUREKA
- COST</td></tr>
<tr><td rowspan="2">EU Member States</td><td>Germany</td><td>Helmholtz – Russia joint Research Groups[50]</td><td>Four joint researches would be financed every year by the Helmoholtz Association and the Russian Foundation for outstanding young Russian scientists</td></tr>
<tr><td>France</td><td>Russian Foundation for Basic Research [51]</td><td>Joint Russian-French projects, funded by the National Centre for Scientific Research of France (Centre National de la Recherche Scientifique)</td></tr>
</table>

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[47] [47] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report Russia: An Analysis of EU-Russian Co-operationin S&T
[48] Richard Burger, Science Counsellor Delegation of the European Commission to Russia: EU-Russia science co-operation: Where are we?, *Information & Brokerage Conference on Information & Communication Technologies in the EU FP7*, Moscow, 28.10.2008
[49] Source: ftp://ftp.cordis.europa.eu/pub/fp7/docs/icpc-list.pdf
[50] Helmoholtz Association of German Research Centres - http://www.helmholtz.de/en/research/co-operations/international_projects/promoting_young_scientists_on_an_international_level/helmholtzrussia_joint_research_groups/
[51] Russian Foundation for Basic Research - http://www.rfbr.ru/eng/default.asp?doc_id=6137

	The Netherlands	The Dutch Russian co-operation programme[52]	To bridge the science and technology collaborative relationships between two countries.
	Switzerland	Scientific and Technological Co-operation Programme Switzerland-Russia[53]	Some four million euros (CHF 6.850 million) are for collaboration with Russia in the field of science and technology
		SCOPES programme[54]	To strengthen the scientific co-operation between Switzerland and Eastern European countries, including Russia. Funded by the Swiss National Science Foundation and the Swiss Agency for Development and Co-operation.
	Denmark	Strategic co-operation in 2000 between Denmark Danish National Research Foundation (DRF) and Russia	The State Committee of Ecology and Natural Resources in St Petersburg - A joint research programme promotes researches into regionally-specific environmental and energy problems.
BRIC Country- RUSSIA	**The Russian Foundation For Basic Research**	Organises various programmes for its scientists who wishes to arrange international research activities and provides financial support: [55] • Continuous Joint Competitions by the Russian Foundation for Basic Research and the German Research Society • Continuous Competitions of Russian-German Projects under the programme International Research Training Groups • A Continuous Competition for Joint Russian and French Research projects in the Framework of International Associated Laboratories and International Research Associations • Continuous Competitions for Bilateral Russian-Austrian Research Projects	

Table 11: Programmes available for EU-Russia cooperation

[52] The Netherlands Organisation for Scientific Research - http://www.nwo.nl/subsidiewijzer.nsf/pages/NWOP_5V6B7Q_Eng
[53] Federal Department of Foreign Affairs (Switzerland) - http://www.eda.admin.ch/eda/en/home/reps/eur/vrus/embmos/ruemed/scipro.html
[54] Swiss National Science Foundation - http://www.snf.ch/E/international/abroad/scopes/Pages/default.aspx
[55] Russian Foundation For Basic Research - http://www.rfbr.ru/eng/default.asp?doc_id=6368

III. Priorities for Research and International Co-operation

Information on common priority areas of research can be observed from coordinated calls and topics under discussion:

- Food
- Agriculture and Biotechnology
- Energy
- Health
- Nanotechnology and New Materials
- aeronautics
- nuclear fission
- Space research.

According to the Russian Ministry of Science, the currently prioritized research areas in Russia are:

- Safety and counteraction to terrorism
- Life systems
- nanosystems industry
- Information and telecommunication systems
- Rational wildlife management
- Transport, aviation and space systems
- Perspective arms, the military and special techniques
- Power and energy conversion

France, Germany and United Kingdom are some of the European countries that Russia tends to co-operate with due to their leading positions in S&T and the good know-how knowledge that would benefit the Russian domestic research and reforms of the S&T units. As a result, joint research and projects, mobility of S&T researchers and personnel, and exchange of information appeared more frequently.[56]

2.2.3. MOST ACTIVE PLAYERS IN EU-RUSSIA CO-OPERATION

I. Countries

A compilation of 72 R&D projects (past and present) that included at least one EU and one Russian partner, and funded by INTAS[57], EU FP 5,6,7, INTERREG and EUREKA initiatives was reviewed. The table below shows the EU countries that most often appear in this project collection:

[56] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report Russia: An Analysis of EU-Russian Co-operationin S&T, p.16

[57] INTAS was the International Association for the promotion of cooperation with scientists from the New Independent States of the former Soviet Union established in 1993 by the European Community and like-minded countries as an international not-for-profit association, under Belgian law. Following the proposal of the European Commission to discontinue INTAS at the end of the 6th Framework Programme, the General Assembly agreed that INTAS would be in liquidation as of 1 January 2007, winding-up its activities and with no new activities to be started from that time. More information can be found at http://www.intas.be.

EU COUNTRY	PARTICIPATION IN PROJECTS WITH A RUSSIAN PARTNER
Germany	47
France	31
Italy	31
Poland	28
United Kingdom	28
Sweden	25
Netherlands	23
Finland	21

Table 12: S&T Cooperation agreements between EU countries and Russia

While Germany, France and Italy are the most active EU countries in research collaboration with Russia, according to the database employed, 15 EU member states have had active agreements with Russia. They are: Austria, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Holland, Poland, Romania, Slovakia, Slovenia, Spain and United Kingdom. About 30% of all identified projects involved neighbouring countries of Russia.

II. Institutions

The analysis showed that, in most cases, the leading role in research cooperation between the EU and Russia has been played by HEIs (including universities, technical universities and research/scientific institutes of various kinds). In very few cases, private companies were also involved.

In terms of activeness of Russian HEI's in the projects, numerous institutes of the Russian Academy of Science (Institute of Biomedical Chemistry, Institute for Information Transmission, Institute of Internal Medicine, Zoological Institute, etc) played the most active role. In fact, out of the 72 projects compiled, 37 of them had one of these institutes as a partner.

Regarding the participation of Russian universities, the following were found to be the biggest players:

MOST ACTIVE RUSSIAN UNIVERSITIES
Kaliningrad State University
Petrozavodsk State University
Saint Petersburg State University
Moscow's State University
Immanuel Kant State University

Table 13: Most active Russian universities in EU funded projects

2.2.4. MAIN AREAS AND TYPES OF CO-OPERATION

I. <u>Common areas of co-operation:</u>

The focus in cooperation activities of Russian HEIs is very similar to the priority spheres of development of science, technologies and techniques in the Russian Federation, and focused on the following R&D areas (in order of importance):

- Industry and industries technologies
- Biology and medicine
- Environment and climate

- Information and communication technologies
- Energy
- Agriculture

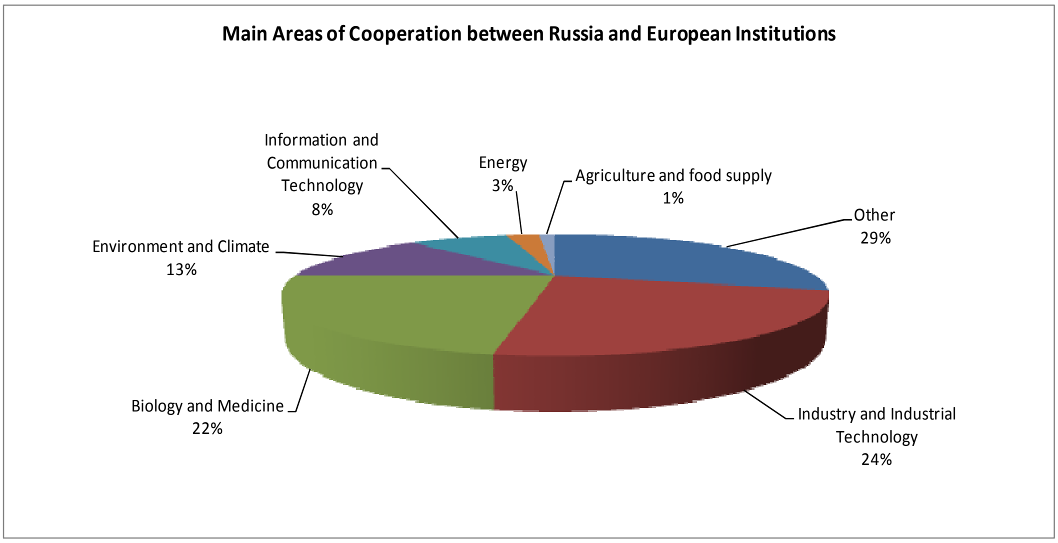


Table14: Main areas of EU-Russia R&D cooperation

II. Common types of co-operation:

Most projects were research projects in the framework of the 5th, 6th or 7th Framework programme, followed by INTAS, Interreg and Eureka projects.

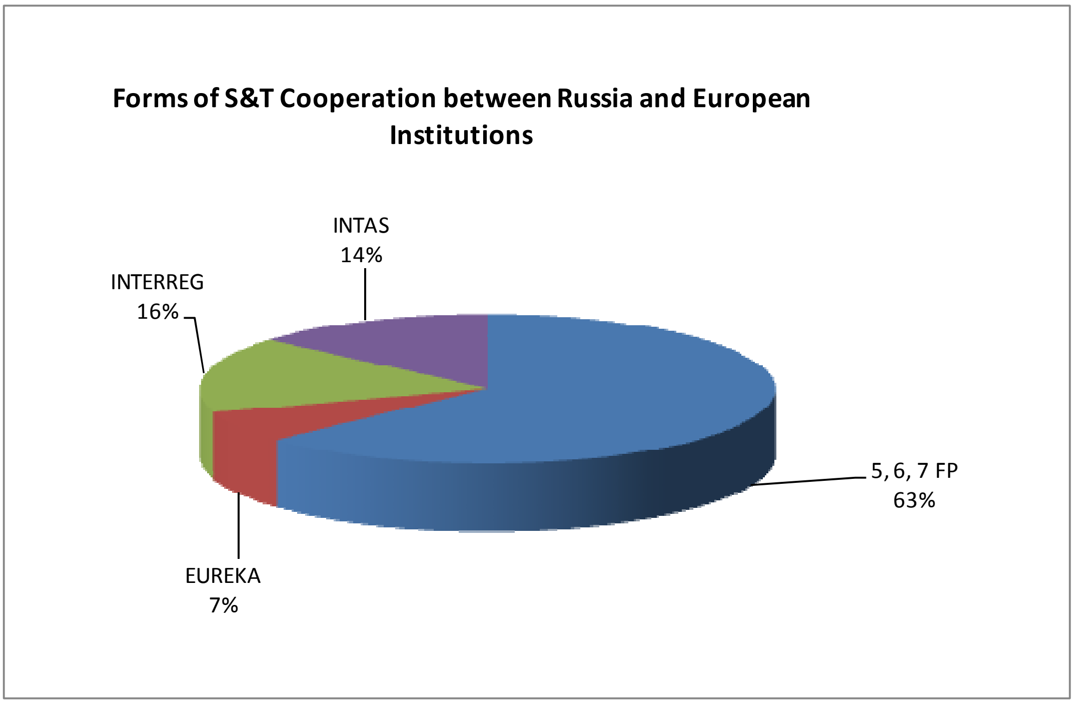


Table15: Common forms of EU-Russia R&D cooperation

Furthermore it is worth to mention that In the EU Framework Programme for Research and Technological Development, Russia was most active participants among the BRIC countries in the FP6 (470 participations), followed by China (392 participations), Brazil (159 participations) and India (139 participations).[58]

2.2.5. SOURCES OF FUNDING

European Union funds are the prevailing source of funding for R&D co-operation projects of Higher Education Institutions from Russia and EU.

On Member States level, funding sources are located within the national research funding schemes and are not devoted specifically for the Russian targeted co-operation. Funds cover mobility of researchers, funding of workshops and networks, joint S/T projects, institutional co-operation (e.g. joint labs). Funding institutions are governmental organisations and related agencies responsible for the implementation of governmental programmes (e.g. Hungarian Government Office for Research and Technology), non-governmental funding agencies (e.g. Academy of Finland) or scientific organisations (e.g. French National Research Centre, German Helmholtz Association).
The Russian counterparts are usually the foundations (e.g. Russian Foundation for Basic Research, Russian Foundation for the Humanities and to a lesser extent the Foundation for the Assistance of Small and Innovative Enterprises) or the Academy of Science.[59]

As follows, a non-exhaustive list of institutions providing funding for R&D and cooperation:

I. **Russian institutions**

- Russian Foundation for Basic Research
- Russian Foundation for the Humanities
- Foundation for the Assistance of Small and Innovative Enterprises
- Academy of Science

II. **Member States**

- DAAD (German Academic Exchange Service/Deutscher Akademischer Austausch Dienst)
- Alexander von Humboldt Foundation (Alexander von Humboldt-Stiftung)
- DFG (German Research Foundation / Deutsche Forschungsgemeinschaft)
- Hungarian Government Office for Research and Technology
- French National Research Centre

III. **Multi country:**

European Union - programmes:

- Framework Programmes
- COST
- Eureka
- Interreg

[58] European Commission, FP6 Data, 2008
[59] Scenarios for a Coordinated Approach to Sustainable Science & Technology Co-operation with the Eastern Neighbours of the EU - http://www.increast.eu/_media/Brochure_Scope_East.pdf

2.2.6. CASE STUDIES' MAIN FINDINGS

In order to learn more about the particularities of R&D cooperation among EU and Russian Higher Education Institutions, some specific projects were selected and interviews conducted. The following tables summarise the main findings from these case studies. The complete case studies can be found in section 4.2 of this report:

I. **Case Study on the METAMORPHOSE project**

PROJECT	**METAMaterials ORganized for radio, millimeter wave, and PHOtonic Superlattice Engineering**
DURATION	48 months (01/06/04- 31/05/08)
PROGRAMME	Sixth Framework Programme Project Reference: 500252
OBJECTIVE	The main scientific objective of this Network is to develop new types of artificial materials, called metamaterials, with electromagnetic properties that cannot be found among natural materials. The results of this development should lead to a conceptually new range of radio, microwave, and optical technologies, based on revolutionary new materials made by large-scale assembly of some basic elements (microscopic and baroscopic) in unprecedented combinations. These artificial electromagnetic functional materials are engineered to satisfy the prescribed requirements.
PARTNERS	• One Russian university • Eighteen EU universities • Three EU research centres and institutes • One EU company
PROJECT INITIATION	• The partnership of the Russian university with many other participants of the project begun more than 10 years ago. • They have worked together in many scientific publications in international journals and conference's reports.
IPR ISSUES	• At the start of cooperation IP issues were not considered. • The partners signed a contract with the "typical" paragraph about IP, but this matter was not further discussed. • If any partner had any IP issues, they kept it in silence. • The Russian team did not encounter any IP problems.

Table 16: Case study on the METAMORPHOSE project

II. **Case Study on the MINIGAS project**

PROJECT	**Miniaturised Photoacoustic Gas Sensor Based on Patented Interferometric Readout and Novel Photonic Integration Technologies**
DURATION	36 months (01/04/08- 31/03/11)
PROGRAMME	Seventh Framework Programme; Project Reference: 224625
OBJECTIVE	Building and demonstrating a miniaturised sensor sub-system that achieves two or three orders of magnitude better sensitivity than other optical measurement methods could achieve at similar package volume, as well as lower cost and wider temperature range of operation. In addition to greenhouse gases, the sensor will also be able to detect explosives vapours and chemical agents such as nerve gases, when integrated in homeland security sensor systems. Moreover, it could have broader consumer benefits such as improved air conditioning in buildings.
PARTNERS	• One Russian research institute • One EU research centre • Six EU companies

PROJECT INITIATION	The partners of the project cooperated with each other before within the framework of few projects not co-financed by the EU, but carried-out under bilateral agreements with the Russian partner.
IPR ISSUES	• IP issues were considered in the original cooperation agreement, including: ownership, costs of protection, and future commercialization, with standard IP clauses. • An Exploitation Committee has been established to manage project IP results and to settle IP issues more effectively, with representatives from all partners. • So far, most results are protectable by copyright, as well as secret know-how, protectable by non-disclosure agreements. • Technology brought into the project by one of the partners will be protected by patents. Currently, there are three PCT patent applications pending relating to this technology. The patent protection is sought both in Europe and Russia, and the owner will be the partner who invented the technology before joining the consortium. • In terms of the IP results generated by the projects itself, it has not been settled yet, who becomes the owner of IP rights (but possible it will be all partners). • The cost of protection IP results generated by the project will be covered by all participants, according to the Consortium Agreement and the decision of the Exploitation Committee. • Depending on the outputs of the project and the decision of the Exploitation Committee, all available ways of IP commercialisation will be considered, including ventures, licences, etc. • Awareness and knowledge of handling IP issues in Russia Higher Education Institutions can enhance the degree of cooperation. It contributes to more successful outputs of the cooperation.
HINDERS	In terms of management of project, so far there have not been any problems or legal, cultural or other barriers.
FUTURE COOPERATION	• The project partners are open for future research cooperation. • Some potential projects are being considered for cooperating with Russian partners. • The partners agree Future cooperation in higher education and research in Russia and the EU would increase, but the detailed reasoning for farseeing such trends cannot be specified.

Table 17: Case study on the MINIGAS project

2.3. INDIA

2.3.1. METHODOLOGY

This section is to demonstrate trends of the co-operation between EU and Indian HEIs. The findings and perspectives from both sides, EU and Indian, would be illustrated respectively. The findings and analysis presented here are non-exhaustive and yet, it provides an overview of RTD cooperation with India. Data was collected through relevant websites with complimentary access.

2.3.2. DRIVES OF CO-OPERATION & AGREEMENTS

I. Political Relations and Agreements:

Despite of the decade-long history of EU-India S&T cooperation, the numbers of collaboration with EU is still relatively less than with Brazil, China and Russia. A stronger bonding between two countries did not come about until the signature of Science and Technology Co-operation Agreements in October 2002 that focused on the exchange of S&T researchers and personnel, and the participation of a wide range of institutions. [60]
The first ever EU-India Ministerial Science Conference in 2007, held in New Delhi, also recognised the importance of S&T co-operation between EU and India and it was discussed that more effort would be made on global health, environment and energy issues through international S&T cooperation. [61]
A new important component of EU-India S&T relations is the launch of coordinated calls for proposals within FP7.

India has had bi-lateral S&T cooperation agreements with all the larger European countries and most of the smaller EU member nations for over half a century. Bilateral types of cooperation between the EU and India seem to be substantially more common than is the case with the other BRIC countries.

II. Programmes promoting co-operation

The following table shows various programmes that are available for institutions and researchers from EU and India to cooperate with each other at three different levels: European Union level, EU Member States level and the BRIC country level, i.e. India.

[60] CREST OMC Working Group, Internationalisation of R&D – Facing the Challenge of Globalisation: Approches to a Proactive International Policy in S&T – Country Report India: An Analysis of EU-India Co-operationin S&T, p.23
[61] India-EU Ministerial Science Conference: The New Delhi Communiqué - http://ec.europa.eu/research/iscp/pdf/new_delhi_communique_signed_en.pdf

LEVEL		PROGRAMMES	
European Union		- FP6, FP7 (FP 6: Ca. 80 projects) - Joint call for proposals in computational materials science (both EU and India committed €5 million to it) - Asia link	
EU Member States	**Germany**	Indo-German Science and Technology Centre[62]	It encourages joint research and development projects and the centre is co-financed with the Germany Federal Ministry of Education and Research and the Indian Ministry of Science and Technology.
	France	Indo-French Centre for the Promotion of Advanced Research (IFCPAR)/ Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)[63]	The establishment of the centre is to increase the opportunity of research between both countries and managed by 10 members, five from each country.
	Italy	Indo-Italian Executive Programme of Scientific and Technological Co-operation[64]	A programme for scientists exchange from both countries and it is co-funded by the Italian Ministry of Foreign Affairs and Indian Ministry of Science and Technology.
	United Kingdom	The Research Council´s Energy Programme[65]	India is one of the priority regions in coal and carbon capture and storage; the programme is funded by EPSRC.
	Denmark	The Danish council for Strategic Research [66]	A Memorandum of Understanding (MoU) on biotechnological research was signed in 2004 and long term collaboration relationship started.
BRIC Country- INDIA	**International Technology Transfer**	The programme facilities the promotion and activities of international technology transfer on behalf of the	

[62] Research in Germany - http://www.research-in-germany.de/coremedia/generator/dachportal/en/06__Regions_20in_20Focus/Indien/Indo-German_20Science_20and_20Technology_20Centre.html
[63] IFCPAR - http://www.cefipra.org/aboutcentre.htm
[64] Embassy of Italy in New Delhi - http://www.ambnewdelhi.esteri.it/Ambasciata_NewDelhi/Menu/I_rapporti_bilaterali/Cooperazione+scientifica/Accordo_di_cooperazione/
[65] EPSRC - http://www.epsrc.ac.uk/ResearchFunding/Programmes/Energy/Intro.htm
[66] Danish Agency for Science, Technology and Innovation - http://en.fi.dk/news/denmark-and-india-expand-collaboration-on-biotechnological-research-1

	Programme [67]	Ministry of Science and Technology.
	Indo-Italian Executive Programme of Scientific and Technological Co-operation[68]	Sponsored by Indian Ministry of Science and Technology so as to promote the knowledge exchange with Italian scientists.
	The S&T International Co-operation Division of the Department of Science & Technology, Ministry of Science and Technology	Sponsors distinctive programmes for Indian researchers collaborate with scientists worldwide:[69] • Indo-Spanish Joint Programme of Co-operation in Science and Technology • Indo-Italian POC in S&T 2008-2010 • Indo-Swiss Joint Research Programme • India Poland Programme of co-operation in Science & Technology

Table 18: Programmes available for EU – India cooperation

III. Priorities for Research and International Co-operation

According to the Joint Statement following the European Union - India Summit held in Marseille on 29 September 2008, the priority areas of S&T cooperation between EU and India are: energy, clean development and climate change, space policies including global satellite navigation.

Further priorities for cooperation can be observed from the new joint calls for proposals, and priorities of the 7th framework programme. Thus far joint calls were issued in areas such as computer sciences, environment and energy.

2.3.3. MOST ACTIVE PLAYERS IN EU-INDIA CO-OPERATION

I. Countries

An analysis of 160 projects on EU-India S&T cooperation during the period 1994-2009, funded by a diverse range of international bodies and international cooperation funds (e.g. European Commission, Aga Khan Foundation, Oxfam, BAIF Development Research Foundation...), revealed the United Kingdom as the most active player, followed by Italy, the Netherlands, France, Germany and Denmark.

EU COUNTRY	PARTICIPATION IN PROJECTS WITH AN INDIAN PARTNER
United Kingdom	35
Italy	22
The Netherlands	16
France	16
Germany	16
Denmark	16
Belgium	8
Austria	7
Norway	7

Table 19: S&T cooperation agreements between EU countries and India

[67] Department of Scientific & Industrial Research - http://www.dsir.gov.in/tpdup/ittp/ittp.htm
[68] Embassy of Italy in New Delhi - http://www.ambnewdelhi.esteri.it/Ambasciata_NewDelhi/Menu/I_rapporti_bilaterali/Cooperazione+scientifica/Accordo_di_cooperazione/
[69] S&T International Co-operation, Department of Science and Technology (India) - http://www.stic-dst.org/what.html

When using data from the CORDIS database on past and present EU funded research projects with India (starting in 1990, and lasting until 2012), 215 projects were compiled. As it is shown in the graph below, the United Kingdom, Italy, the Netherlands, Demark and Germany were the top five partners, with more than 20 projects with India. Besides that, it was found significant cooperation in other European countries, including France, Sweden, Belgium, Spain and Finland, with more than 10 projects.

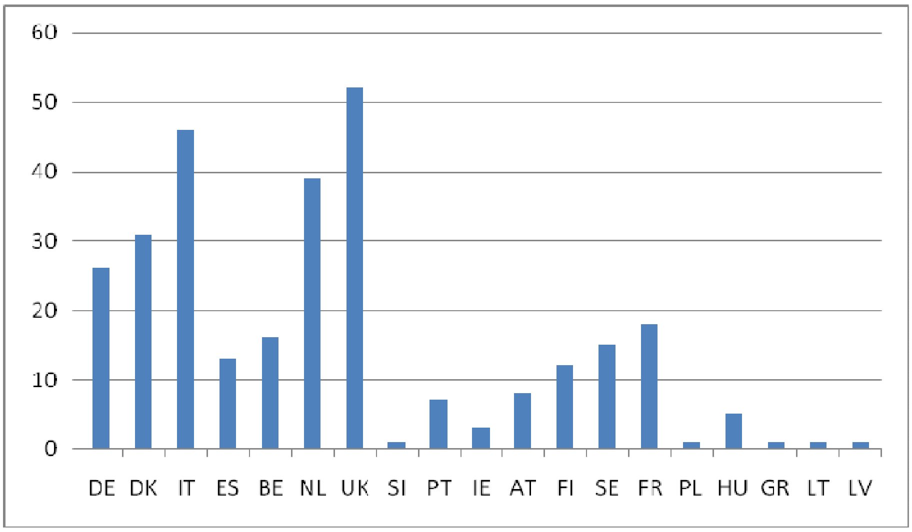


Table20: EU funded research projects with an Indian partner

Regardless the database employed, the Netherlands, Demark and Italy seem to consistently be the most active when it comes to participation in research projects with India.

II. Institutions

As the dynamism of institutions would be affected by its financial circumstances and the funding received, in India, the cooperation was found primarily lying on the research and academic institutes, whilst corporate research and ministerial bodies of Government handling the projects were also found active. This is illustrated in the graph below:

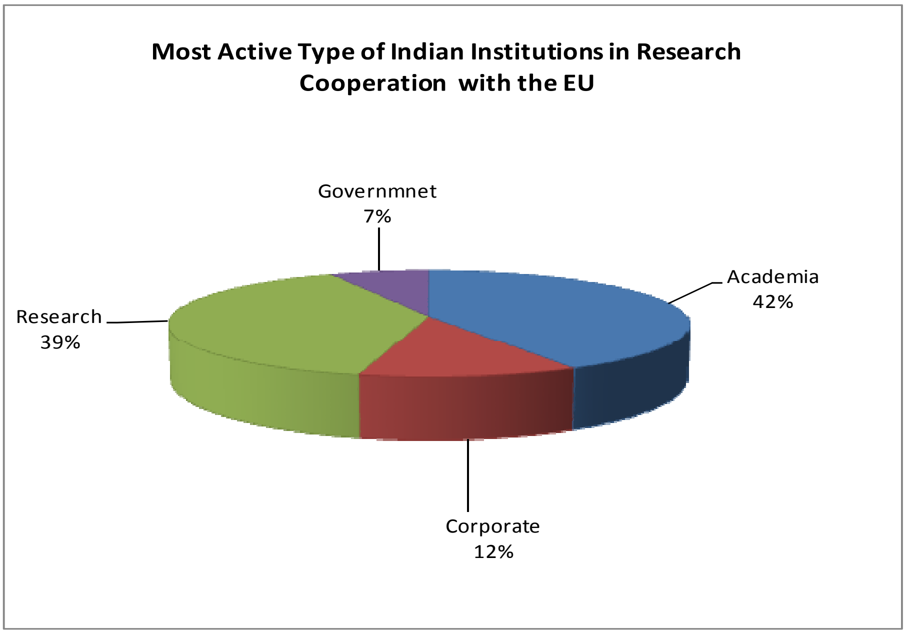


Table21: Most active type of Indian institutions in EU-India research projects

From the data retrieved from the CORDIS database, the following were found to be the most active Indian Universities in EU funded projects:

INDIAN UNIVERSITIES
University of Delhi
University of Agricultural Sciences
Jawaharlal Nehru University
Tamil Nadu Agricultural University
Banaras Hindu University

Table 22: Most active Indian universities in EU funded projects

As for the research Institutes and Centres in India, these were the most enthusiastic in this type of collaborations:

INDIAN RESEARCH INSTITUTES AND CENTRES
Indian Institute of Technology
International Centre for Genetic Engineering and Biotechnology
The Energy and Resources Institute
Tata Energy Research Institute
Indian Institute of Science
Council of Scientific and Industrial Research
All India Institute of Medical Sciences

Table 23: Most active Indian research centres and institutes in EU funded projects

2.3.4. MAIN AREAS AND TYPES OF CO-OPERATION

I. <u>Common areas of co-operation:</u>

The co-operation was mostly found to cover the areas of Information and Communication Technologies, Environment and Climate, Biology and Medicine, Industry and Industry Technology. However, a significant number of projects was found to lie in interesting but heterogeneous areas of co-operation which were not covered by the common terminologies used as above, were mentioned in the category 'Other'. This category was largely covered by co-operation in the areas of education, management and legal matters.

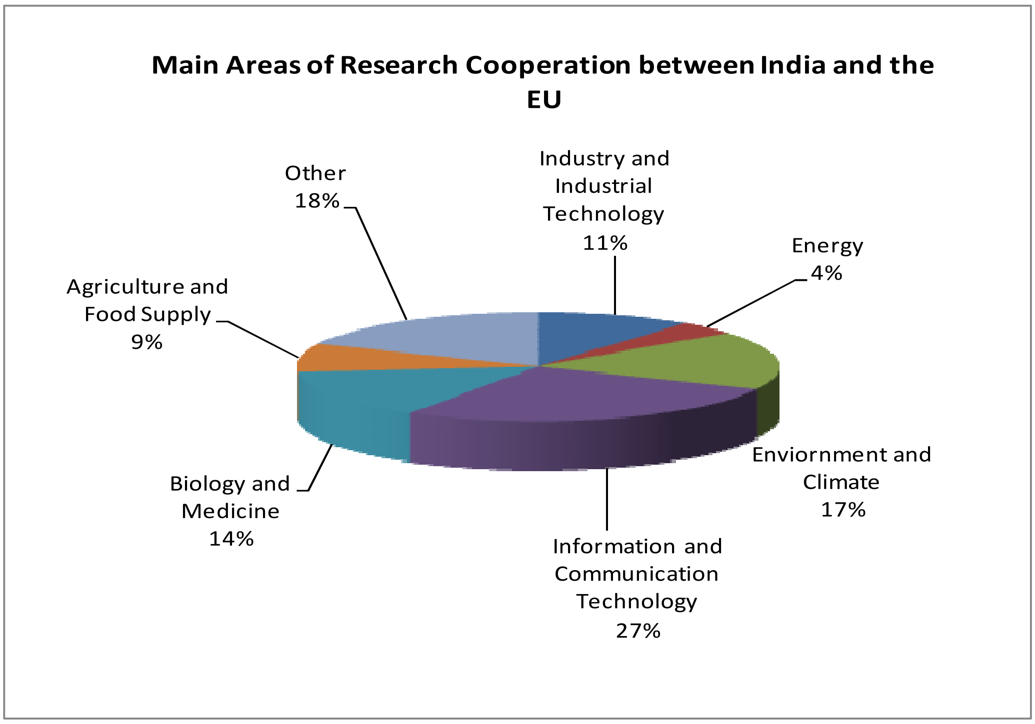


Table24: Main areas of cooperation in EU-India research projects

II. Common types of co-operation:

According to the data analysed (mainly Framework programme projects in this case), the most common form of co-operation emerging out of our classification is 'specific support action', followed by integrated projects. The graph below shows the share of each type of cooperation:

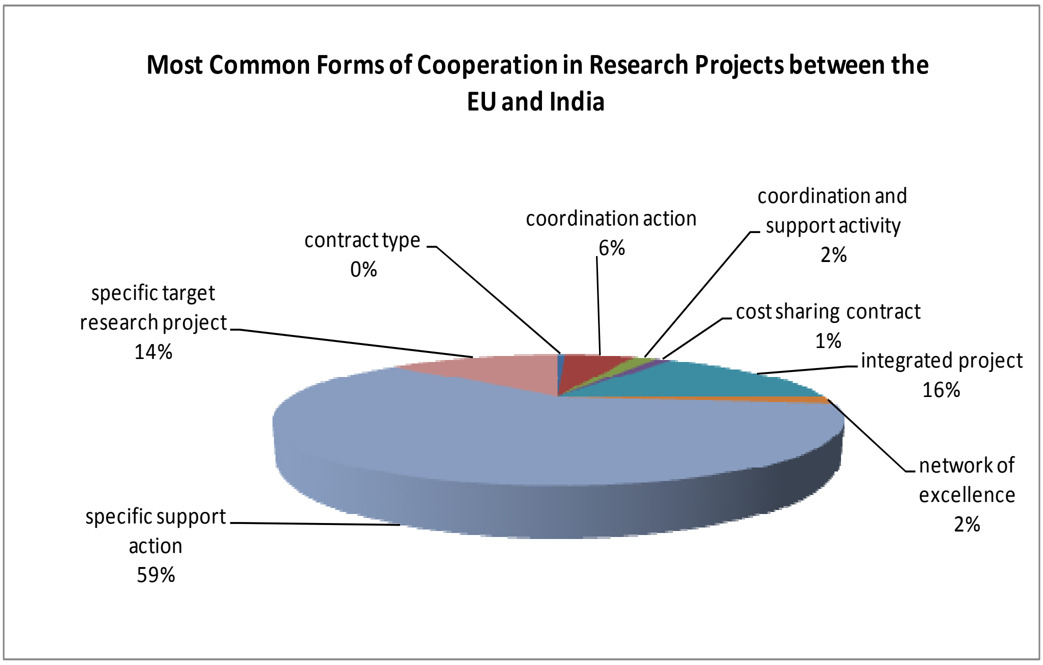


Table25: Most Common types of Cooperation in EU-India Research Projects

2.3.5. SOURCES OF FUNDING

Overwhelming majority of co-operation was funded by international organisations e.g. World Bank and European Commission.

I. **Indian Institutions:**
- Department of Science & Technology, DST
- Department of Information Technology, DIT
- Ministry of Human Resource Development
- Department of Biotechnology, DBT
- Board of Research in Nuclear Science, BRNS

II. **European Institution:**
- Deutscher Akademischer Austausch Dienst, DAAD
- The Deutsche Forschungsgemeinschaft, DFG
- Federal Ministry of Education and Research, BMBF
- Foundation Research Strategies, FRS
- Max Planck Institute Information

III. **Multi-country cooperation:**
- European Union- programmes:
- Framework Programme
- Erasmus Mundus

2.3.6. CASE STUDY'S MAIN FINDINGS

In order to learn more about the particularities of R&D cooperation among EU and Indian Higher Education Institutions, a specific project was selected and interviews conducted. The following table summarises the main findings from this case study. The complete case study can be found in section 4.3 of this report:

I. **Case Study on the ASSIST project**

PROJECT	**Comprehensive Approach to understand Streptococcal diseases and their Sequelae to develop Innovative Strategies for diagnosis, Therapy, prevention and control**
DURATION	36 months (01/01/07- 31/12/09)
PROGRAMME	Sixth Framework Programme; Project Reference: 32390
OBJECTIVE	The main objective of the ASSIST project is to develop a test that will allow a quick diagnosis of streptococcal strains with potential to cause serious disease. With an effective test, doctors could concentrate on these cases, and administer proper antibiotic treatments in poor countries.
PARTNERS	• Two Indian research institutes • One Indian university • Two EU research centres and institutes • One EU university

<table>
<tr><td>PROJECT INITIATION</td><td>In 2005, Prof. Chhatwal (Helmholtz Centre for Infection Research) initiated the first contacts for this project with all participating centres. He had had long term associations with some of the Indian partners.
The other European partners knew each other from international conferences and the exchange of published information in their fields, but had never worked together in a research project before.</td></tr>
<tr><td>IPR ISSUES</td><td>The consortium agreement included an IP component covering ownership of pre-existing know-how and the knowledge produced by the project, access rights to information generated by the project, protection of results capable of commercial application, exploitation and beneficiaries from patentable results.
It was expected that the project produce a patentable clinical test. This will achieved using the services of an external patent agency or lawyer.
<u>IP in International Research Collaboration</u>
Importance that the project contract managed cooperation on all levels and defined IP issues very clearly from the beginning.
IP clauses are needed to protect all parties involved.
It would be a failure if some of the partners holdback their results fearing that they won't be credited for their findings.
IP agreements can be tricky when institutions and multiple countries and legislations are involved.
Most European universities have developed IP ownership policies and established legal departments with IP expertise and support.
IP issues, while important, are not the partners´ main concern when engaging in international research collaborations: "Scientists do research for advancement, and not just for getting patents."
Patenting results presents challenges to researchers: the need to protect results with patents often delays the dissemination of research, but the patents are required in order for the findings to become attractive on the market.
<u>IP in India</u>
European partners´ view:
Lack of knowledge on how IP issues are handled in India.
Clarity in the definition of IP issues from the start can enhance and attract new cooperation, as it makes researchers and their institutions feel protected.
Indian partners´ view:
In India, all international research projects need to be scientifically and administratively approved by different committees and ministries. If this happens, it means that it has adequate agreements in place, including one covering IP rights, providing peace of mind to international partners.
There has been an increase in awareness of IP issues in the last 10 years, and today "India has very strict rules on IP rights.</td></tr>
<tr><td>HINDERS</td><td>Unexpected delays in obtaining approvals and licenses from the Indian governing bodies for the exchange of biological samples.
The degree of bureaucracy in India interferes too much with the running of international research collaborations, according to some EU partners.
Reporting to the EU implies a huge amount of paperwork, which is perceived as "lengthy", "boring" and even "annoying". European HEIs often have offices that provide administrative guidance. Those partners who lack this support find the reporting extremely difficult.
The EU payments policy and schedule, often subject to reporting requirements, make some partners feel that the EU does not "trust" them anymore. Also, it is not in accordance to the projects' different spending rhythms during their lifetime.
Fluctuation in the money received by partners located in non-euro countries and the lack of adjustment to changing local payment scales creates confusion</td></tr>
</table>

	among partners. • The schedule of payments affects the shipment of samples from third countries, which do not have other sources of funding and cannot get advances from their institutions. • The EU gives great scientific flexibility which contrasts very much with its "stiff, strict and picky" reporting requirements.
SUPPORTS	• Great selection of partners that complement each other very well. • High quality of the interdisciplinary research approach. • Meticulous planning and coordination. • External support from "well connected" Indian researchers. • Cooperation and teamwork between participating centres. • Timely and effective execution of plans • Cross pollination of ideas, and unrestricted exchange of information
FUTURE COOPERATION	• Some partners anticipate further intensification of this cooperation. • The collaboration will definitely continue until all the findings have been published, which will probably happen beyond the end of the project. Trends • The growth in collaboration between the EU and India in the fields of transnational medical and basic research in the past few years indicates further strengthening of ties between them. • All the partners foresee an increase in international collaboration in higher education and research between the EU and India. • For the **European partners**, India has a lot of potential, especially in the bioscience field. • For the **Indian partners**, the scientific pool, new government, technical development, clinical resources and advanced level of English in India predicts excellent opportunities for future cooperation between European and India HEIs. • In the past few years there has been an increase in bilateral agreements for research collaboration and exchange of scientists between India and Europe, particularly with France, Hungary and Germany.

Table 26: Case study on the ASSIST project

2.4. CHINA

2.4.1. METHODOLOGY

The aim of this section is to present a summary of the trends in R&D co-operation between Higher Education Institutions in EU and China. The main inputs for this analysis were obtained through searching various online databases and websites. The overview presented here is non-exhaustive and developed from two perspectives – EU on one hand and China on the other.

From the EU perspective, the data collected is to a large extent based on information found in the European Commission's database CORDIS[70]. Other data sources were investigated (e.g. EUROSTAT, RIPORTAL, Science Accelerator, Chinese Science Citation Database, etc.)[71], but the research team found the CORDIS database to give the best overview of ongoing research co-operation. When research projects were identified through other data sources, it was often found that they were present in CORDIS as well. This led us to the decision of focusing on CORDIS as the main source of information in order to obtain an overall view of Higher Education R&D co-operation trends between EU and China. As a result, almost all research projects analyzed were co-financed by the EU.

In the study, we identified more than 140 R&D co-operation projects and agreements that incorporated a Chinese partner institution. These projects were categorized and studied more in detail. As a result we found that only 89 of these projects fulfilled all the criteria set up by the consortium (e.g. R&D areas must be of high importance, project must include at least one EU HEI and one Chinese HEI, etc.). These 89 projects were evaluated further and in the following sections, statistics and conclusions derived from these projects would also be presented.

On the other hand, our Chinese counterpart had a non-exclusive data collection from various resources concerning the study. The data analysed here could be classified into three parts:

- The first part is based on the Asia-Link programme initiated by the EU in which many HE institutions of China have benefited from the multilateral networking in 75 projects.
- The second part is 8 projects from the website of EU delegation of EC to China, in which the energy conservation and environment protection were identified as the most common areas in the co-operation agreements.
- The third part is from the website of National Nature Science Foundation of China (NNSF), which demonstrates some general long-term agreements between NNSF and European institutions.

2.4.2. DRIVERS OF CO-OPERATION & AGREEMENTS

I. Political Relations and Agreements

Today, the EU is China's second largest trade partner meanwhile, China is the EU's largest partner. EU relations with China were established in 1975 and are governed by the 1985 EU-China Trade and Co-operation Agreement. Given the depth and breadth of today's strategic partnership, negotiations began to upgrade this to a Partnership and Co-operation Agreement in 2007.

Apart from regular political, trade and economic dialogue meetings, there are over 24 sectoral dialogues

[70] http://cordis.europa.eu
[71] For a complete list of data sources used, please see the Annex on data sources

and agreements ranging from environmental protection to industrial policy, education and culture. [72]

This history of co-operation has always included a significant scientific research and technological dimension. Through the signature of a **Science and Technology (S&T) co-operation agreement in 1998**, the EU-China co-operation has received a strong impetus and significant progress has been recorded in research fields such as ITER, SARS, Galileo, energy, new materials, biotechnology, aeronautics , space, hydrogen economy and information technology. The co-operation between EU and Chinese research is a success and is growing in vigour and stature.[73]

Furthermore, two Plans, Medium- and Long-term National Plan for Science and Technology Development 2006-2020 and the 11th Five-Year Plan 2006-2010, were launched concurrently with the FP7, which further intensified the S&T co-operative relationship between EU and China. [74]

China-Europe Science & Technology and Innovation Policy Forum is planned to be set-up. [75]

II. Programmes promoting co-operation

The following table shows various programmes that are available for Brazilian researchers to apply for collaboration with EU at three different levels: European Union level, EU Member States level and the BRIC country level, i.e. China.

LEVEL		PROGRAMMES	
European Union		- Framework Programmes: FP6, FP7 - Asia-Link - ASEF - Erasmus Mundus	
EU Member States	**Sweden**	Sino-Swedish Strategic Cooperative Programme on Next Generation Networks[76]	Financed by The Swedish Governmental Agency for Innovation Systems – VINNOVA
	Ireland	CO-REACH[77]	Managed by Science Foundation Ireland and the Ministry of Science and Technology of the PRC, a China-Ireland scheme to promote research activities between two countries.
	France	The French-Chinese foundation for sciences and their applications – FFCSA [78]	Financed by the French Academy of Sciences and organises exchange with industry groups and research institutions.

[72] http://ec.europa.eu/external_relations/china/index_en.htm
http://ec.europa.eu/research/iscp/eu-china/about_en.html
[73] Joint Declaration on EU-China Research Co-operation: Building a Knowledge for Growth Pact
[74] Horvat, Manfred and Lundin, Nannan, Review of the Science and Technolog Cooperation between the European Community and the Government of the People´s Republic of China, p.5
[75] China's EU Policy Paper (full text); October 2003, http://ec.europa.eu/external_relations/china/policy_en.htm
[76] VINNOVA - http://www.vinnova.se/
[77] CO-REACH – http://www.co-reach.org
[78] French Academy of Science - http://www.academie-sciences.fr/index.htm

	Germany	Sino-German Research Projects[79]	A funding programme for bilateral collaboration; managed by the German Research Foundation and National Natural Science Foundation of China
	Italy	Sino-Italian Co-operation Program for Environmental Protection[80]	Managed by Italian Ministry of Environment and the State Environmental Protection Administration of China
	UK	The Research Council´s Energy Programme[81]	China is one of the priority regions in renewable energy technologies; the programme is funded by EPSRC.
	The Netherlands	China-Netherlands Joint Scientific Thematic Research Programme (JSTP)[82]	It fosters collaboration of Sino-Dutch research teams and to share experiences by holding joint projects.
BRIC Country- CHINA	Research Fellowship for International Young Scientists[83]	To bring animation to the research in the field of nature science to the young scientist and bridge international collaboration and promote academic exchange; funded by the National Natural Science Foundation (NSFC) of China	
	Programme Strategic Scientific Alliances (PSA)[84]	15-year long programme for some priority research fields between the Netherlands and China; co-funded by The Netherlands Ministry of Education, Culture and Science and the Chinese Ministry of Science and Technology.	

Table 27: Programmes available for EU - China cooperation

III. Priorities for Research and International Co-operation

The China 2002-2006 Country Strategy Paper funded by the European Commission contains three **focal areas:** support for social and economic reform; the environment and sustainable development; and good governance and the rule of law.

The strong **Chinese interest** in developing co-operation with the EU in the field of higher education was demonstrated in the context of the EU-China Higher Education Dialogue which took place in Beijing for the first time in November 2005. Moreover, in the recent Joint Statement of the Helsinki EU–China

[79] The Sino-German Centre for Research Promotion - http://www.sinogermanscience.org.cn/english/e3c.htm
[80] Sino-Italian Co-operation Program for Environment Protection - http://www.sinoitaenvironment.org/indexe02.asp
[81] EPSRC - http://www.epsrc.ac.uk/ResearchFunding/Programmes/Energy/Intro.htm
[82] Nuffic Neso - http://www.nesochina.org/home/news-events/news-archive/2009/march/cooperation-china-china-netherlands-joint-scientific-thematic-research-programme-jstp/
[83] NSFC - http://www.nsfc.gov.cn/english/07fd/07.html
[84] Royal Netherlands Academy of Arts and Sciences - http://www.knaw.nl/china/psa/index.html

Summit where the Chinese side expressed interest in making further progress with the EU on this topic.

It also illustrated that the EC response strategy 2007-2013 will focus on three areas of intervention and the indicative funding for the seven-year period amounts to €224 million:

- The first subject is Trade, economic and social development.
- The second subject is Environment, energy and climate change.
- And the third one is Human Resources Development, Governance, and Capacity Building, esp. in Higher Education.

When analysing projects from the website of EU delegation of EC to China, **energy and environment** were identified as the most common interests.

In the **higher education sector**, Chinese postgraduate students have been extremely successful in taking up scholarships to undertake masters courses in the EU under the Erasmus Mundus Programme, both under the worldwide core funding for the programme, and under a special €9 million 'China Window' financed under the 2004-2006 NIP. The total intake of Chinese Erasmus Mundus masters students for academic years 2005/2006 and 2006/2007 is approximately 300.[85]

2.4.3. MOST ACTIVE PLAYERS IN EU-CHINA CO-OPERATION

I. Countries

In order to review which countries are the most active in terms of R&D Co-operation between HEIs in China and EU, more than 140 R&D co-operation projects and agreements were analysed. These projects were categorized and studied more in detail. However, only 89 of these projects fulfilled all the criteria set up by the consortium (R&D areas, partners, etc.). We found that the most active EU countries in research cooperation with China were France, Germany, United Kingdom, Italy and Spain. The following graph offers a more comprehensive view:

EU COUNTRY	PARTICIPATION IN EU PROJECTS WITH A CHINESE PARTNER
France	61
Germany	58
United Kingdom	54
Italy	48
Spain	47
Netherlands	35
Belgium	31
Switzerland	30
Sweden	27
Finland	19
Denmark	17
Greece	16
Poland	16
Austria	15
Portugal	11

Table28: EU funded research projects with a Chinese partner

[85] EC: Country Strategy Paper- China 2007-2013. http://www.asia-programming.eu/wcm/dmdocuments/draft_CSP_China.pdf

II. Institutions

In order to understand which the most active institutions are, the five EU countries with more R&D cooperation agreements with China were analysed and the most dynamic institutions among these five countries are:

COUNTRY	INSTITUTION	R&D COOPERATION AGREEMENTS WITH CHINA
France	Institute National de la Recherche	22
	Thales	5
	Commissariat a l'energie atomique	4
	Institute National de la Santé	3
Germany	Fraunhofer gesellschaft zur foerderung der angewandten forschung	16
	Max Planck gesellschaft	6
	Deutsches zentrum fuer luft und raumfahrt	4
	Reinisch-Westfaelische technische hochschule Aachen	3
	T-systems	3
United Kingdom	The University of Surrey	5
	University College London	4
	University of Bristol	3
	University of Cambridge	3
	University of Edinburgh	3
Italy	University of Bologna	8
	Consiglio Nazionale delle Ricerche	6
	Universitá degli studi di Roma	4
	Politecnico di Milano	3
	Universita di Pisa	3
Spain	Atos Origin España	4
	Universidad Politécnica de Madrid	4
	Advanced Communication Research & Development	3
	Instituto de Aplicaciones de las Tecnologías	3

Table 29: Active country-based European Institutions in China

On the other hand, the most frequent Chinese participants were universities, institutions (e.g. Fudan University, Tsinghus, Shanghai Jiaotong University, Tianjin University, Tongji University, Beijing Institute of Technology, Zhejiang University, Chinese Academy of Sciences) and Foundations (National Natural Science Foundation of China).
In addition, the EC and distinctive governmental agencies (CNRS) together with numerous Foundations (DNRF) and academic organizations (NSFC, EPSRC, DFG) of EU played an active role in the co-operation.

The diagram below shows the four main Chinese universities cooperating with EU alongside the category labelled “other” which represents all other Chinese partners.

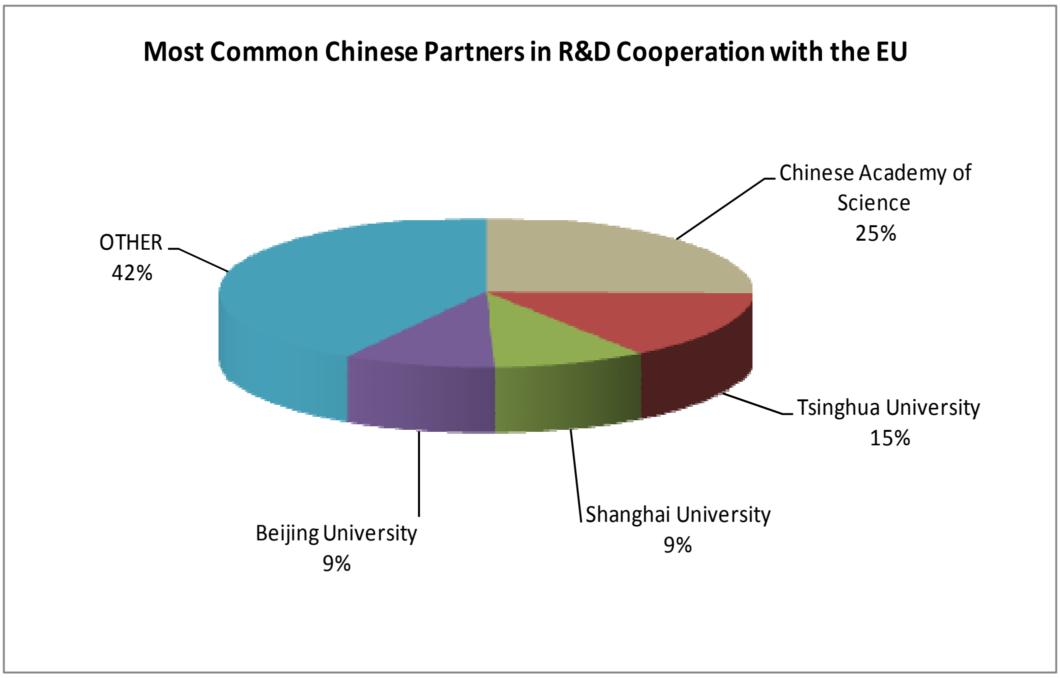


Table30: Most common Chinese partners in R&D cooperation with the EU

2.4.4. MAIN AREAS AND TYPES OF CO-OPERATION

I. <u>Common areas of co-operation:</u>

The following graph shows the main areas of R&D co-operation between EU and China, based on the sample analysed:

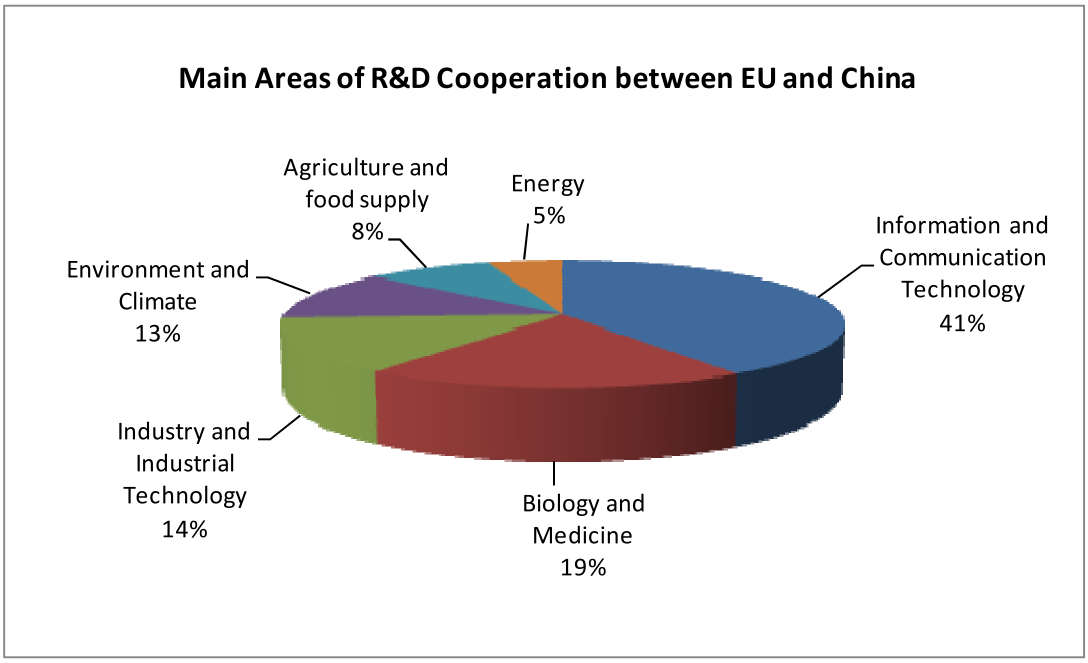


Table31: Main areas of R&D cooperation between the EU and China

II. Common types of co-operation:

The usual form of co-operation between EU and China is projects and partnerships within research institutions. Other common forms of co-operation were based on general or long-term co-operation agreement (e.g. "Asia Link" programme), co-financing, exchange of staff/students and joint research.

2.4.5. SOURCES OF FUNDING

The possible and prevailing sources of funding for co-operation were EC, National Foundation of China and minority of governments of EU countries (e.g. France government is the funding source of "Medical training programme" among Nancy hospital, University of France, Zhongnan Hospital and Wuhan University of China).

Due to the fact that data collected were from the European Commission database CORDIS, most of the R&D co-operation projects between EU and China were partly financed by the EC, specifically within 6th and 7th Framework programmes (FP6 and FP7).

2.4.6. CASE STUDIES' MAIN FINDINGS

In order to learn more about the particularities of R&D cooperation among EU and Chinese Higher Education Institutions, some specific projects were selected and interviews conducted. The following tables summarise the main findings from these case studies. The complete case studies can be found in section 4.4 of this report:

I. Case Study on the JORCEP project

PROJECT	The Joint Research Center of Photonics
OBJECTIVE	Partnership between the Royal Institute of Technology (KTH) in Sweden and Zhejiang University (ZJU) in China to create a center of excellence for both universities, engaging in both research and education. Created in 2003, it collaborates on PhD education and offers an international Master of Science program in photonics.
PARTNERS	• One Chinese university • One EU university
PROJECT INITIATION	• Professors Lars Thylén (KTH) and Sailing He (KTH and ZJU) coined the idea to establish JORCEP. • They had a professional relationship, working at different departments at KTH within related fields and having overlapping research interests. • The choice of ZJU as a Chinese partner was natural as ZJU represents one of the strongest centres for photonics research in China.
IPR ISSUES	• IP issues were not considered when the original cooperation agreement was written. • An additional agreement was written at a relatively early stage covering how to deal with IP. The quality of this agreement is unclear and there is doubt whether this agreement actually would have worked very well in reality or not. • One potential issue to consider is the rules regarding ownership of research results and potential patents: in China the results belong to the university while in Sweden the individual researcher is the owner. • To date, most has been basic research without much focus on applications. The

	filling for patents has a potential difficulty for the future; the centre has now entered into an agreement with Ericsson and is more likely to produce applications from the research. • For the **European partners**, it is not clear whether increased awareness of handling IP issues in Chinese HEIs could enhance the degree of cooperation between the EU and China: if there is an interest and need of cooperating with a Chinese partner, there is always a solution to the IP questions.
HINDERS	• Funding for the centre's operating activities has generally been scarce and it has required an excessive amount of time and a constant battle. • Numerous administrative difficulties sending Swedish researchers to China as expatriates, due to lack of experience and funds. • Organizational and work cultures differ a lot between Sweden (organizations tend to be flatter and less hierarchical) and China (working relationships are more formal and authoritarian, and bosses tend to have more responsibilities). • Differing educational rules and regulations in the two countries requires careful planning.
SUPPORTS	• The centre had from the start a permanent Swedish presence on site in China.
FUTURE COOPERATION	• The centre will continue to operate and the level of activity will increase in all areas, i.e. research, PhD education and Masters´ education. • An additional Swedish partner will be added, Lund University, whose research is complementary to KTH's and not overlapping, contributing greatly to the centre's future. • To strengthen the cooperation further more, links between the partner universities should be made on all levels, and not to only rely on personal relationships, since the cooperation becomes too dependable on the participation of certain individuals. • To further reduce the risk for the centre it is vital to secure financing for centre specific activities. <u>Trends</u> • It is likely that research cooperation between European countries and China will increase. China is investing an increasing part of their GDP in research and the GDP is increasing itself. There are many good researchers from China in other parts of the world and they do return home with a research mentality that is not only technology focused. • The benefits from a European point of view to work with a Chinese partner are not always so clear-cut, so it is important to think about them before engaging in a research collaboration project. The Chinese partners know their motives for this very well.

Table 32: Case Study on the JORCEP project

II. <u>Case Study on the ENTTRANS project</u>

PROJECT	**The potential of transferring and implementing sustainable energy technologies through the Clean Development Mechanism of the Kyoto Protocol**
DURATION	24 months (01/01/06- 31/12/07)
PROGRAMME	Sixth Framework Programme; Project Reference: 22673
OBJECTIVE	To explore how the Clean Development Mechanism of the Kyoto Protocol could support the transfer of sustainable energy technologies to developing countries.
PARTNERS	• One Chinese university • Two EU research centres • Two EU universities • One EU Foundation • Four other non-EU HEIs
PROJECT	• There has been much attention to sustainable development and environment

INITIATION	protection in China since 1990. • In 1993, the Joint Implementation Network (JIN, a Dutch foundation and coordinator of the ENTTRANS project) contacted Prof. Deng Gang, dean of the Department of Foreign Affairs at Kunming University of Science and Technology (KUST), to invite this institution to join this project. • There had not been previous collaborations or professional contacts between these institutions before this project.
IPR ISSUES	Although IP issues were covered in the agreement signed by the partners, the Chinese partner was not totally aware of that: **Chinese partner´s view:** • IP issues were ignored when at the signing of the project contract because there was a lack of IP protection ideology. • There may have some IP issues in the project, but they were inconspicuous. • They have not encountered any IP problems. • It is important how to avoid technology divulgence related to national secrets. • Even though ENTTRANS is a basic research, it is clear that there are also some potential IP issues such as ownership of previously and project-generated knowledge, ownership of rights, use and exploitation of results, etc. • Those potential IP issues did not occurred during the project´s life. • It is not clear whether enhancing the awareness of IP could help with the cooperation and bring out more successful results.

Table 33: Case Study on the ENTTRANS project

III. Case Study on the CILIA project

PROJECT	**Customized Intelligent Life-inspired Arrays**
DURATION	48 months (01/09/05- 31/08/09)
PROGRAMME	Sixth Framework Programme; Project Reference: 16039
OBJECTIVE	To identify the common principles underlying the widespread use in nature of arrays of mechanical sensory cells for the extraction of meaning under adverse conditions and to make those principles available for design of engineered systems.
PARTNERS	• One Chinese university • One EU research centre • Seven EU universities
PROJECT INITIATION	• The partners constituting the driving consortium had experience from cooperating with each other from before through the research projects CICADA and CIRCA (financed by FP5) • There was a common interest for continuing working together, so a proposal was created and submitted to FP6.
IPR ISSUES	• The consortium contract included an IP component covering joint inventions, applications of patents, regulations of access rights, etc. • The consortium arranged a workshop on IP so that everyone could get a general understanding of IP and be aware of potential issues and opportunities. • No inventions, applications, products, processes, etc. had been developed jointly by the consortium at the time of the writing of this case study (February/March 2009). • Some partners have developed some applications by their own. In those cases, it is their property and they decide how and what protection to seek, how to exploit it, and they will bear the costs of protection. IP in China **European partners' view:** • Increased awareness of handling IP issues do not necessarily enhance the degree of cooperation between EU and Chinese HEIs, but if someone is afraid of cooperation with China due to uncertainty on how IP will be dealt with, then there is a problem and, consequently, training in IP would help.

	• It is not obvious that IP awareness would affect research collaboration between universities in EU and China. It is mostly personal contacts that decide whether there will be cooperation or not. • Some partners stress that they would never check the IP clauses in a Chinese partner university in order to decide whether to cooperate with them or not. It would be a research based decision.” • For projects with a specific goal of producing an application as a result, IP is essential, but if it is a pure research project then it is not a big issue. • China is more active regarding IP than people in Europe think. • IP awareness will probably contribute to more successful outcomes.
HINDERS	• Initial hurdles from the EU to fund a project that incorporated a Chinese partner, without previous complete clarification of the Chinese contribution. Today there is more experience in financing Chinese partners, and the rules for how and when it is valid to do so are clearer. • Administrative obstacles from the EU to incorporate a ninth partner once the project had been approved and funded. • Conflict between one Chinese and one EU partner regarding the sharing of research data. The Chinese partner is afraid that data might disappear outside the consortium and is therefore unwilling to share it. This seems to be not a China specific problem, but rather due to researcher pride and ‘fear’ of loosing ownership or recognition of research data. There are tensions about sharing research results in all research communities, indifferent to the country or context. To avoid them, it is necessary to establish trust among partners through positive experiences and by always giving full credit to the source. Also, there should an IP agreement, signed by all partners, on what research data should be shared, by whom, and what may be done with the data.
SUPPORTS	• Multidisciplinary work team, bringing their own competences to the table and achieving great results as a team: this collaboration is more than the sum of all parts. • Individual contributions were high quality, but it was the collaboration and exchange of ideas what made this project a real success.
FUTURE COOPERATION	• Several new projects will be created as a result of the joint research cooperation. Two of the CILIA partners will participate in the ChiRoPing project, a new EU financed project (FP7) aimed at studying the eco-locations of bats. • More ‘spin-off’ projects have been formed as well by other partners belonging to the CILIA consortium. Trends • Research cooperation between EU and China will increase in the future. China and India are investing heavily in both education and research and Europe should try to accompany and cooperate with them rather than compete. • Increased number of Chinese students are going to Europe for their education and training (and vice versa), creating networks and contacts that will lead to increased cooperation. • European companies are moving parts of their operations to China (not only manufacturing, but also product development). This will boost research collaborations with that country. • The quality of Chinese research and education is improving, which makes it inevitable to increase the amount of cooperation between Europe and China. • China is giving a lot more freedom to researchers now, so the amount of research cooperation will go up. • It is hard to identify in which research areas the cooperation is likely to increase more than others.

Table 34: Case Study on the CILIA project

3. CASE STUDIES OF EU – BRIC COOPERATION

3.1. BRAZIL

3.1.1. MAIZE FOR ACID SOILS

MAIZE FOR SUSTAINABLE CROPPING SYSTEMS ON TROPICAL ACID SOILS FROM MOLECULAR BIOLOGY TO FIELD CULTIVATION

The project "Maize for sustainable cropping systems on tropical acid soils - from molecular biology to field cultivation" was conducted as a specific research and technological development project that intent to demonstrate and confirm the role of European Community in international research. Aiming to understand and improve the responses of plants exposed to acid soils and aluminum toxic levels. This project has a strategic role for Brazil and other maize producing countries, bringing benefits to smaller scale farmers and enabling agricultural frontier expansion.

This case study has been written as part of the project IP UniLink, which aims to study the trends in higher education in research and development (R & D) and the feasibility of increasing research partnerships between European Union (EU) and BRIC countries.

Background

This project was initiated through a contact between Professor Pere Puigdomenech from Spain and Professor Walter Horst from the Hanover University. Professor Marcelo Menossi, a researcher from the State University of Campinas (UNICAMP), was supervised by Mr. Puigdomenech.

The project proposal was submitted by the Center Molecular Biology and Engenharia Genética (CBMEG) of the State University of Campinas (UNICAMP) to the European Commission in August of 1999, and the terms of the project were approved in October of 2000.

A multidisciplinary strategy was engaged in the project to study the plants tolerance mechanisms on acid soils and attempt to characterize the mechanisms and genes involved in resistance to acidic conditions. The obtained results would be utilize to develop new varieties and be tested under real conditions. Water Horst – that coordinated the project (University of Hannover) stated that: "The corn is sensitive to soil acidity as a result of two indirect effects, the solubilization of aluminum ions, which are highly toxic to plants, and the reduced availability of phosphate ions, that are vital for growth. But little was known about the acidity resisting mechanisms that certain maize varieties had."

Ten partners from Latin America, Europe and Africa (see list of partners on the next page) involved in the project. This partnership has brought benefits to all participants and the project itself as the diversity of the group and the sharing of genetic resources originated in the Caribbean, sub-Saharan Africa and Latin America have brought the possibilities to work on a larger scale and also to analyze its adaptation to different types of regions (different environments).

The contract was signed on 18 October 2000 and ended on October 31, 2003. The 36-month project was mostly funded by the European Community.

The Project

In this section we will present the project details: objective, the partners, the project structure, funding and activities.

Objective:

1. Increase corn's production and productivity, and enhance corn cropping systems sustainability on soils with toxic levels of aluminum and low availability of phosphate in sub-Saharan Africa, South America and the Caribbean. By:

    - Maize germplasm development with high efficiency on soils contaminated with aluminum and poor in phosphate.
    - Maize germplasm development of with high resistance to aluminum.
    - Maize germplasm development with high efficiency in the capture and use of phosphate.
    - Maize technologies development for the agronomic and economic sustainability on acidic soils.

2. Encourage scientific knowledge in the abovementioned areas through the association of the research groups experience in Europe and the Third World countries with an international reputation in this scientific field.
3. Promote scientific and technological cooperation between European Community research institutions and those from the Third World countries, focusing on high-quality scientific research applied to practical applications.

Specific Aims:

The project has the following scientific and technological aims:

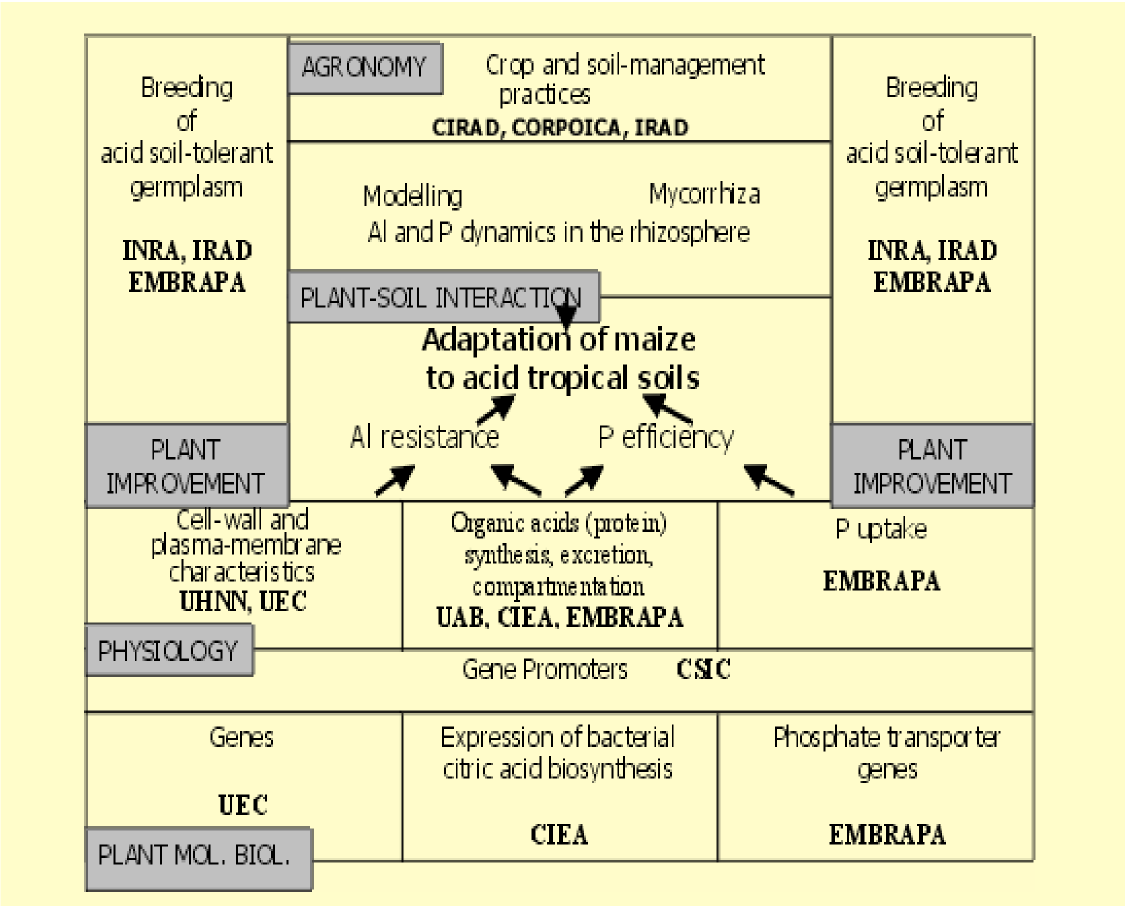
- Characterize the physiological mechanisms related to the resistance to aluminum and efficiency in the capture of phosphate and its relationship.
- Evaluate the physiological mechanisms effects on the aluminum mobility and phosphate in the rhizosphere and in its availability induction.
- Identify genes and promoters, and gene products related to resistance to the A1 and the efficiency of P.
- Express genes related to resistance to the A1 and the efficiency of P in transgenic plants and evaluate the effects analyzing the strength and efficiency of the A1 P transgenics compared to the wild.
- Develop more efficient technologies for breeding, based on better understanding of genetics, physiology and molecular biology of resistance to Al and the efficiency of P using conventional molecular markers.
- Develop germplasm adapted to the target regions acid soils in the ACP and LAM.
- Assess the contribution of improved germplasm in increasing the productivity and sustainability of cropping systems of maize in areas targeted in the ACP and LAM.
- Develop sustainable maize cultivation systems germplasm combining new and improved agronomic practices in the areas targeted ACP and LAM.

Partners:

- University of Hannover (UHANN) - Germany (the coordinator), provided Coordinating and representing all the other participating institutions.
- Autonomous University of Barcelona (UABCN.DBA) - Spain
- Superior Council for Scientific Research (CSIC.CID.DGM) - Spain
- Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) - Brazil
- Colombian Corporation of Agricultural Research (CCIA.PNRB) – Colombia
- Institute of Agricultural Research for Development (IRADCM) - Cameroon
- National Institute for Agricultural Research (INRA) – France

- State University of Campinas (UNICAMP.BME) - Brazil
- Center for International Cooperation in Agronomic Research for Development (CIRAD.AMIS) - France
- Center for Research and Advanced Studies of IPN (CIEAIPN.UBV) - Mexico

Project Structure:



Funding:
The project total estimated cost was 1,248,209 EUR (one million two hundred and forty-eight thousand and two hundred and nine euros). The European Community funded the maximum permitted of EUR 892,740 (eight hundred and ninety-two thousand and seven hundred and forty euros) for the entire project and 76,000 (seventy-six thousand Euros) for Brazil.

Activities:

The coordination meetings were held at the beginning of the 2nd year and at the end of the project. The researchers that took part in the project communicated through e-mails as well as personally in workshop in Shrimps, Germany and in Colombia.The meetings were held in Yaounde, Camaroon, for the following reasons:

i. Sub-Saharan Africa is among the maize production systems design and improvement on acid soils main target areas because of the need to improve poor small landowners conditions;

ii. The second meeting was held in to coordination with the Hanover 14th. International Symposium on Nutrition of Plants (IPNC) in 2001. This allowed researchers to monitor participants and contribute articles in this international meeting.
iii. The final meeting of Coordination happened in South America, Colombia, a country that presents a large deficit in corn production and a high potential for maize production expansion in the acid savanna. All observed results were presented in national and international conferences and published in Conference Proceedings and national and international journals.

Intellectual Property Rights:

The project rules on intellectual and industrial property, advertising and reliability, were all described in the Annex II of the contract, effective for all partners on the day after the signature. With clear and well defined rules regarding the knowledge ownership, knowledge protection, knowledge enhancement, general principles for access rights, access rights for exploitation, access rights exploration conditions, Refusal to granting of access rights for exploration, technological implementation plan, Content of technological implementation plan, the project and knowledge advertising and communication, Reliability, Communication of data for evaluation and standardization and Incompatible or restrictive compromise .

Partial results:

The partial results are part of the final report of this project and are also in part in RTD Info[86]. The project had the following cultural and institutional constrains at the beginning:

a) Difficulties in obtaining institutional information from the State University of Campinas (UNICAMP). The large amount of detailed information required by the European Union was a constrain;
b) Difficulties in shipping vegetal material from countries to countries. It was due to the countries´ institutional reasons (as authorization from agencies for samples transference) and customs problems (disabled the material when arrived at its destination).

In spite of the constraints, careful coordination, extra attention paid to each phase of the project, was one of the factors that helped overcome the difficulties. Besides that, all veteran researchers further smoothed the development.

As a result of the consortium's research – carried out in particular in Barcelona (Autonomous University and the Instituto de Biologia Molecular), in Irapuato, Mexico (Centro de Investigación y Estudios Avanzados), in Brazil (University of Campinas) and in Hanover – we now have a clearer picture. It is all down to the root tip or apex. The root tips of maize varieties that are resistant to acidity have a cell membrane with a very specific composition that is enriched with saturated fatty acids, and a cell wall which is poor in pectin, thereby reducing the propensity to fix aluminum and the resulting inhibition of cell growth. In addition, the ability to excrete citrate makes it possible to detoxify the aluminum and, at the same time, improve phosphate uptake. A number of genes, expressed under the control of the same promoter (a region of a DNA molecule that, like a switch, controls a gene's protein expression) are expressed specifically in the root tip in the event of a lack of phosphate or an excessive aluminum concentration. "It is very important to characterize this promoter because it makes it possible to conceive transgenic genes that express a gene introduced purely into this tissue – thus in the root tip, and not in the complete plant – thereby avoiding energy wastage and an expression in the grain that is consumed," explains Marcelo Menossi of the University of Campinas (Brazil). (INFO IDT, 2005).

[86] Original URL: http://ec.europa.eu/comm/research/rtdinfo/special_inco/05/article_2842_en.html

When these new cultivars become available, how should they be grown? And, in the meantime, what are the best agricultural practices for growing existing acid-resistant cultivars? These are the questions asked by the Cameroon (IRAD) and Colombian (Corporación Colomiana de Investigación Agropecuaria) partners. International co-operation on such a project brings clear benefits, making it possible to compare the effectiveness of agricultural practices on acid soils that are otherwise very different. Two sites were selected: the grassy plains of Villavicienco, in Colombia – former pastures now used for intensive arable farming – and the mid-altitude former forest zones of Yaounde in Cameroon. Research in both cases showed that spreading lime, which reduces the soil acidity chemically, made it possible to improve yield, as did the spreading of chicken manure. Green manure or rotating maize with other leguminous crops that enrich the soil did not yield useful results.

The next stage is to convert this research data into simple recommendations on use to farmers. Work on modelling the rhizosphere, the all-important interface between the soil and the root, is being carried out in Montpellier (France) by the Institut national de recherche agronomique (INRA) and the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD). This will make it possible to extrapolate these recommendations to any tropical soil for which the key parameters are known, such as aluminum and phosphate content and, of course, acidity. This model will also incorporate climatic parameters, in particular rainfall. In fact, maize is a very thirsty crop and one of the effects of acidity is to reduce the size of the root system, which is already limited, thus rendering it more sensitive to drought. At a time when some climatic models suggest that climate warming threatens to reduce rainfall in tropical regions, and the present increase in the atmosphere's CO_2 content is causing a mechanical increase on soil acidity, it is important to anticipate the consequences for maize crops.

Finally, this project offered many opportunities for young researchers from Latin America as well as from Europe, with no fewer than 22 PhD and 30 Masters students participating in the research.

When the project finished no new breeding was developed that could be patented or protected, that is the main reason for not having any Properties Rights (PI) issue. According to professor Menossi the new breeding development takes many years and as this project was of short term there was not enough time for that. But, the discoveries made in this cooperation probably will be used as base for other research that will be able to develop new breadings or improved species that will need to be protected by PI.

This project also made new cooperation's possible with other partners in Brazil, as with Embrapa, but those cooperation projects haven't been fruitful for Unicamp until the moment. In professor Menossi´s opinion, there will be a tendency to reduce the cooperation between the Brazilian and the European high education institutions in the near future. This scenario is due to some factors like:

1. The increase in Brazilian internal resources for research.
2. The number of researchers in the country is steady and the amount of attributions for the same ones has only increased, thus leaving little time for larger projects.
3. The development of internal research nets in Brazil makes the need of international cooperation less essential.

Professor Menossi proposition is that to increase future cooperation's between Brazil and EU the ideal would be the development of joint research proclamations for new research.

3.1.2. GENEO-TROPECO

SUSTAINABLE MANAGEMENT OF NEO-TROPICAL TREE GENETIC RESOURCES: COMBINING MOLECULAR AND MODELLING METHODS TO UNDERSTAND STRUCTURE AND DYNAMICS OF GENE DIVERSITY

Tropical forests are complex ecosystems and their management often involves the sustainable exploitation of a range of resources. Genetic diversity represents an essential component promoting the adaptation of population level and ensuring the abundance of individual species within tropical systems. Many tropical species have their long-term survival threaten due to unsustainable levels of extraction or their habitats being degraded. The need to develop practical, operational systems to manage genetic sustainability originated the GENEO-TROPECO project. It aimed at measuring key genetic indicators of sustainability in tropical forest ecosystems. The goal was to evaluate the level and dynamics of genetic diversity in natural forest populations. The sustainability of current management practices was assessed using computer simulation of field-gathered genetic data. Specific sustainable extraction and management strategies arising from this process were promoted to forestry stake holders.

This case study was written as part of the IP UniLink project[87], and attempts to illustrate an example of research collaboration in a project involving partners from the EU and Brazil. Telephone interviews with some of the key partners and the project final report[88] have been the main sources of information for this case study. The project's website and other documents supplied by the coordinator have provided additional data.

Background

When the GENEO-TROPECO project was designed, some of the partners involved had already been cooperating for many years. Back in 1989, Universidade Federal do Rio de Janeiro and Ghent University signed a collaboration agreement to do research on molecular biology. Several young Brazilian scientists, who had been PhD students and postdoctoral research fellows at Professor Marc Van Montagu's[89] lab at Ghent University, were behind this association. In the early 90's the French National Institute for Agricultural Research (INRA) started collaborative work with scientists from Manaus in the Amazonian. Researchers from Rio de Janeiro joined this group soon after.

INRA, Centro Agronómico Tropical de Investigación y Enseñanza in Costa Rica, and the Natural Environment Research Council (NERC) in Scotland were the partners of one the two EU funded projects on genetic diversity that would lead to the creation of GENEO-TROPECO later on. It was funded through INCO-DEV[90] programmes in framework 3, in conjunction with national partner grants. Entitled *"Assessment of genetic diversity of economically and ecologically important tropical tree species of Central America and the Caribbean: Implications for conservation, sustainable utilization and management"*, it lasted from November 1994 until October 1997. The second of the projects was an *"Assessment of levels and dynamics of intra-specific genetic diversity of tropical trees for conservation and sustainable management",* from November 1997 to July 2001. It was funded under the 4th

[87] The IP-UniLink project is co-financed by the European Commission's Erasmus Mundus Programme, under Action 4 'Enhancing Attractiveness'. The project aims to study R&D cooperation trends between Higher Education Institutions and Research Institutes in the EU and BRIC countries, including an analysis of IP management issues in such collaborations.

[88] The final scientific report of the GENEO-TROPECO project can be found at: http://nora.nerc.ac.uk/2169/1/ICA4_CT_2001_10101_GENEOTROPECO_Final__Report.pdf

[89] Marc Van Montagu is considered the father of biotechnology. This Belgian professor discovered the gene transfer mechanism between agrobacterium and plants, which resulted in the development of methods to alter the bacterium into an efficient delivery system for gene engineering. The discovery opened the era of transgenic plants.

[90] INCO: Specific International Scientific Cooperation Activities

Framework Programme of the EU, and included three additional partners[91]. It was in the last meeting of this project when the participants started the planning and prepared the first draft of the proposal for the GENEO-TROPECO project.

The Project

GENEO-TROPECO started on the 1st of February 2001, and finished in January 2006, with a duration of 48 months. It was funded by the European Commission under the 5th Framework Programme. The rationale behind the project was to move beyond disperse research. There were several individual research projects on genetic sustainability in the Neotropics[92], but the different sampling strategies employed made it very difficult to combine data. The project aimed to standardize the sampling design.

Goals:

The main goal of the GENEO-TROPECO project was to study the influence that life history and ecological traits have on the structuring of genetic variation for a range of forest tree species from across the Neotropics. The specific objectives were:

1. To examine the structure and dynamics of genetic variation for a range of species within natural ecosystems and identify the main factors that are responsible for the partitioning of variation within a range Central and South American forest tree species.
2. To examine the impact of identified extraction methods/habitat degradation on selected economically important species.
3. To produce a model that will integrate field observations and DNA laboratory work to provide realistic simulations of the impact of differing land-use strategies and extraction regimes on the genetic resource base of impacted species.
4. To improve capacity to execute sound natural forest management by improving awareness of genetic implications of natural forest management and implementation of a modelling approach to setting sustainability objectives.

Partners:

There were six partners in the consortium, three from Europe, two from Brazil and one from Costa Rica:

- NERC Centre for Ecology and Hydrology, UNITED KINGDOM (Coordinator)
- Centro Agronómico Tropical de Investigación y Enseñanza, COSTA RICA
- National Institute for Agricultural Research, FRANCE
- Instituto Nacional de Pesquisas da Amazônia, BRAZIL
- Universidade Federal do Rio de Janeiro[93], BRAZIL
- Ghent University, BELGIUM

[91] More information on these research projects can be found at the EU CORDIS database http://cordis.europa.eu and the projects' websites: http://www.edinburgh.ceh.ac.uk/geneo/previous.htm and http://www.edinburgh.ceh.ac.uk/geneo/project1.htm, respectively.

[92] In biogeography, *Neotropic* refers to one of the world's eight terrestrial ecozones. This ecozone includes South and Central America, the Mexican lowlands, the Caribbean islands, and southern Florida, because these regions share a large number of plant and animal groups.

[93] The main researcher, Rogerio Margis, accepted a position at Universidade Federal do Rio Grande do Sul and left Universidade Federal do Rio de Janeiro. Although he continued as a partner, the project remained affiliated with Universidade Federal do Rio de Janeiro.

Funding:

The total funding for the GENEO-TROPECO project was 1332183 Euros, with 900000 Euros coming from the European Commission under the 5th Framework Programme. It was established that the European partners were 50% funded by EU money, and 50% by their own institutions. The Brazilian and Costa Rican partners were 100% funded with EU money for this project. One Brazilian interviewee explains that the actual resources employed by his lab on this project were much higher than the funds received from the EU. In fact, while they spent an average of 20 hours a week per researcher on the project, their salaries were paid by his Brazilian university. Also, some of the PhD and postdoctoral students involved had fellowships from Brazilian institutes. They also applied and received small grants from Brazilian institutions to help with the expenses generated by the project.

The Cooperation Contract:

The cooperation was formalized as per the guidelines and objectives of the 5th Framework Programme of the European Union. The partners signed an EU standard contract model that was, in essence, a research plan. It was considered that an Intellectual Property agreement was not needed at that time. As the project progressed, the need for having a Material Transfer Agreement became utterly necessary. More information on this agreement is provided in the section on Intellectual Property issues below.

Activities:

The partners in the GENEO-TROPECO project conducted research on genetic biodiversity complemented with the following activities:

- Annual meetings were held in rotation amongst partners, alternately in Europe and Latin America:
    - Coordination meeting 1: 25-27 March 2002, Bordeaux, France
    - Coordination meeting 2: 14-16 June 2003, Manaus, Brazil
    - Coordination meeting 3: 5-8 July 2004, Edinburgh, UK.

      This meeting included a workshop for training in use of the ECOGENE simulation model used by the partners.
    - Coordination meeting 4: 3-7 October 2005, Turrialba, Costa Rica

      On the final day of this meeting, a public dissemination workshop was held with the presence of the research and the policy community. The details of this meeting are addressed in the Communication and Dissemination section.

  Some of the partners also met at other biodiversity and genetic conferences and symposia.

- Exchange of staff and students: There were many exchanges between scientific staff involved in the project. In addition, Brazil sent PhD and postdoctoral students for training in France and Belgium, and Costa Rica sent PhD students to Scotland. These visits ranged from short-term stays for training purposes to year long exchanges.

- Publications: Both scientific and non-technical communications were achieved during the project lifetime. It was stated in the contract agreement that each partner was free to publish individual pieces of their research. A significant number of peer-reviewed scientific publications, both individually and jointly, were produced based on results. These ranged in scope from methodological publications to overarching reviews. Amongst other papers, special issues of the journals *Heredity* (Nature Publishing Group) and *Silvae Genetica* were produced. The project's final scientific report summarizes the following publications derived all or in part from project-generated data:

- Twenty-seven peer-reviewed publications between 2002 and 2006, and nine more submitted (at the end of the project)
- Four books
- Two poster presentations
- Eleven PhD theses

- Project website: **http://www.nbu.ac.uk/geneo/**
- Genetic Diversity Board game for schools and colleges

Communication and Dissemination:

Communication amongst consortium partners was maintained primarily by email and the means of the project website that was set up following the first coordination meeting. The website has a public and a private section. In the open-access area there is a description of the project, objectives, partners involved and publications. The restricted area includes information on data analysis, lab methods and techniques, minutes of meetings and shared protocols, outputs and annual and progress reports. There was also a forum where students were able to ask questions to the partners related to the project. This section is not active anymore.

As mentioned earlier, the project produced numerous scientific publications. On a less technical approach, a high-level public dissemination meeting was held at INBio[94] in San Jose, Costa Rica on the final day of activities of the fourth coordination meeting. The format was an open session workshop with attendees from the Costa Rican National Biodiversity Committee, Ministry of the Environment, Centro Agronómico Tropical de Investigación y Enseñanza, and Technological Institute of Costa Rica amongst others. Each partner in the GENEO-TROPECO project made a presentation providing specific case studies featuring work carried out during the project lifetime. The meeting was very well received and attendees expressed appreciation that the scientific community had taken the time to present primary research in a public forum. One of the interviewed partners stressed that the connection between their research and the policy makers is *"critical to manage biodiversity".*

Additional dissemination of the project outputs was achieved through the preparation of a board game for education in primary and secondary schools. The game is called *"La Diversidad Genética Forestal"*[95]. It consists of a double sided board on a "snakes and ladders" design with two levels of questions that deal with aspects of genetic diversity maintenance. There were plans to translate the game from Spanish into Portuguese.

Towards the end of the project, the NERC Centre for Ecology and Hydrology prepared and submitted a proposal to the FP6 INCO SSA[96] call. The bid for a supporting action targeted funding for a workshop in Latin America uniting collaborators in the Geneo-Tropeco with those from other major projects in the field and the principal researchers. *"It would also allow for preparation and translation of dissemination materials and focussing plans for future projects under FP7*." The bid passed all of the required criteria and was placed on the reserve list, but was ultimately not funded.

Intellectual Property Issues

The actual contract agreement of the GENEO-TROPECO project did not include any coverage of Intellectual Property (IP) issues. All the partners interviewed agreed that "the climate" at the start of the project did not indicate the need for a formal agreement on IP. However, as the project progressed, many difficulties with the export of biological samples from Brazil arose. For the protection of IP rights

94 The National Biodiversity Institute (Instituto Nacional de Diversidad in Spanish).
95 Forestry Genetic Diversity.
96 Specific Support Action.

and to ensure that correct procedures were followed in the export and use of sampled tissue material, the text of a *“Material Transfer Agreement for Research-Only Purposes*” was drawn up and agreed between partners. This was followed by legal screening by each of the partners’ institutions. There were no patentable results from this project, and all of the research outcomes were made public via the usual academic routes.

As the partners began discussions for subsequent projects, no one doubted of the need for an IP agreement. When in 2005 they got EU funding for the new project SEEDSOURCE, the collaboration was formalized as a consortium agreement and included provisions on confidentiality and IP rights. The issues covered were:

- Ownership, protection, publication and dissemination of knowledge
- Access rights
- “Have manufactured” rights
- Use of marks
- IP transfer to contractors’ technology transfer companies

The partners signed an agreement for material exchange too.

When asked about the importance of awareness of IP rights to enhance collaboration, one of the partners argued that what really enhances collaboration are the DNA bank databases. He explained that it is standard practice today that where results derived from DNA sequence data are being submitted for publication, *“they must be accompanied by accession numbers showing that they have been submitted to the international databases, which enforces the dissemination of this kind of data, and favours collaboration.”* All in all, there was a common believe among the interviewed partners that increased awareness of IP issues can enhance cooperation with any country. The European partners consulted were positive that there is extensive knowledge of handling IP issues in Brazil. The coordinator of GENEO-TROPECO claimed that all the Material Transfer Agreements and some of the current IP provisions in the SEEDSOURCE project were created *“crafted to the Brazilian demands and requirements. The initiative came from the Brazilian partners.*”

One of the partners, with a long time history of bilateral collaboration with Brazil, reflected that this cooperation would be enhanced by well-defined IP and confidentially agreements. *“We now have a legal department at the University that handles all our contracts and IP agreements. IP is taken more and more seriously by everybody in the administration and in the research community.”*

Another participant indicated that it is always difficult to know at the beginning of the project what kind of outcomes it will produced. Therefore, some guidelines on the partners’ rights and responsibilities regarding IP should be drafted, but “*they should not be too strict to be able to cover any potential outcome”*.

While all the researchers conveyed that raising awareness on IP can be beneficial to any project, they did not seem to be too concerned about it. They showed more interest in having proper material transfer agreements that let them exchange samples between partners in different countries and do their scientific work.

Hinders and Supports

Broadly speaking the project achieved the objectives included in the proposal. “*In most cases the outputs of the work packages significantly exceeded the initial expectations, as demonstrated by the quantity and notably high quality of the scientific output.*” This continued beyond the project lifetime with a number of major publications remaining to be completed.

Hinders:

According to the partners consulted, these were the main barriers the faced during the execution of the project:

- Restrictions on the exchange of samples: Some delays were experienced in the project due to the requirement for a large number of collections to be completed before other analysis could be initiated. This was held back by a change of regulations combined with a change of administration in Brazil, which stopped export of tissue samples from that country for most of the project time: *"The export of samples from Brazil was the major hurdle to the project and consumed a huge amount of time."* At the time of GENEO-TROPECO project, there were major concerns in Brazil regarding biopiracy. A blanket restriction was imposed to the exchange of specimens that seriously affected the timeline of the project. Licences for the collection of plants, animals and other biological materials could take up to two years to be processed in the most complicated cases. Despite these limitations, in most cases, it was still possible to complete analysis and indeed, in the end partners were able to produce data right up to the project end and beyond.

  In 2007 Brazil repealed its tough rules for biological samples and introduced a new system that would issue licences to collect biological material for scientific research more quickly. This new system represented a huge improvement due to its rapidity and the transparency offered, and was expected to have a positive impact in scientific studies. In contrast Costa Rica, a country where the export of biological samples was fairly easy, has recently changed its rules and the transfer has become much trickier and lengthier.

- Samples not sent as promised: One European partner claimed that their Brazilian counterpart did not collect and send to them all the samples that had been agreed. Despite several requests and promises, the situation remained unchanged. According to this researcher, this had a negative impact on the results and quality of publications of this partner's centre.

- Schedule of payments: One Brazilian researcher complained that after the EU sent the initial payment, the second instalment was not wired until this partner completed the reporting for the first year. Since there were several additional documents requested by the EU, *"the payment came many months later."* To pay for the project's expenses in the meantime, this interviewee received an "advance" from the coordinator of the project. This partner acknowledged that it is a complex issue to tackle.

Supports:

The interviewed partners concurred that, from a management point of view, the consortium partners worked extremely well together. One of the most cited aspects of the group in the interviews conducted was the high level of communication, which was labelled as *"fluent and frequent"*. All partners attended annual meetings, shared data, human resources and ideas, and "*maintained an atmosphere of positive interaction*". One partner stressed that *"the individuals that participated in the project were reliable, shared the same interests, and welcomed collaboration. They are a good collection of researchers."*

Finally, this project not only facilitated joint research and exchange of ideas, but it also created new professional relationships between senior and junior researchers for future collaborations.

The Future Cooperation

The six partners of the GENEO-TROPECO project plus one Ecuadorian university and three more European institutes applied and received 1699999 Euros[97] under FP6 for the subsequent SEEDSOURCE[98]

[97] With a budget of 2157467 Euros.

[98] More information on the SEEDSOURCE research project can be found at http://herbaria.plants.ox.ac.uk/seedsource/index.html.

project. It started in May 2005 and will last until the end of January 2010. The project's rationale is to build on previous projects in this area to develop best practice for sourcing and utilising seed for agroforestry and reforestation in the Latin American humid tropics. When the partners have their annual coordination meeting for this project in Australia next year, they are planning to initiate discussions for a new project. One partner said that this collaboration will happen *"if we can obtain funding. FP7 is a lottery, and depends entirely on the next call for proposals. It is possible that we will need to look at smaller bilateral projects between individual partners.*" Another partner agreed and explained that in 2009 there are no calls for projects on biodiversity in Latin America, but they are expecting that this will come up in 2010.

Trends:

The Brazilian partner consulted envisioned an increase in bilateral collaboration between Brazil and European countries. He expressed that Brazilian researchers are very interested in building relationships and engaging in joint research with U.S. institutions too.

Some of the partners expressed their concern on how the current worldwide economic crisis may affect future international research collaboration in terms of funding. One of the interviewees prescribed that with the major change in the EU funding model, there will be problems to organise collaboration projects between Brazil and the EU. *"Until recently, the projects were under the umbrella of the International Cooperation stream, which was independent."* This, however, has changed with FP 7 that integrates international science and technology collaboration throughout the Framework Programme. Financially, *"international cooperation has dramatically decreased in favour of EU projects. Mainstream funds focus on EU questions. It is getting more and more difficult to find common questions that are appropriate for Europe and Brazil."*

For one European partner "*the strength of the research community in Brazil presents a barrier to build international research agreements with scientists*" from that country. Brazil has well-equipped labs, highly qualified human resources and biodiversity and, sometimes, *"they are so confident that it seems they do not need any collaboration from abroad."* Brazilian researchers have *"very strong projects of their own."* The Brazilian interviewee clarified this saying that in Brazil there are two approaches towards research: those scientists who want to engage in discussions at the international level, and those who *"if they have the funds, they feel they don't need to collaborate."* This later type of researchers become interested in participating in research collaboration agreements "*when they are running low on cash."*

The main conclusion we can draw from these remarks is that future research collaboration agreements between Brazil and the EU depend very much on the available funding.

References

Interviews:

- Dr. Stephen Cavers works at the NERC Centre for Ecology & Hydrology in the United Kingdom. The telephone interview was conducted on the 12th of May 2009.

- Prof. Godelieve Gheysen works at the Department of Molecular Biotechnology at Ghent University in Belgium. The telephone interview was conducted on the 13th of May 2009.

- Prof. Rogerio Margis works at Centro de Biotecnologia at Universidade Federal do Rio Grande do Sul, in Brazil. During the GENEO-TROPECO project he was affiliated with Universidade Federal do Rio de Janeiro. The telephone interviews were conducted on the 18th and 21st of May 2009.

Final Report

Cavers, Stephen; Walker, Katherine; Davies, Samantha; Munro, Robert; Home-Robertson, Patrick; Lowe, Andrew; Navarro, Carlos; Finegan, Bryan; Hernandez, Gustavo; Cascante, Carolina; Caron, Henri; Degen, Bernd; Kremer, Antoine; Lemes, Maristerra; Gribel, Rogerio; Margis, Rogerio; Margis, Marcia; Salguerio, Fabiano; Gheysen, Godelieve; Colpaert, Nathalie. 2007 *Sustainable management of Neo -Tropical Tree Genetic Resources: Combining molecular and modelling methods to understand the structure and dynamics of gene diversity. Final Scientific Report. February 2002 - January 2006.* Edinburgh, NERC/Centre for Ecology and Hydrology, 87pp.

Other contracts and agreements

- GENEO-TROPECO Material Transfer Agreement for Research-Only Purposes
- SEEDSOURCE Project Consortium Agreement

Websites:

- GENEO-TROPECO Project: www.nbu.ac.uk/geneo
- EU CORDIS: http://cordis.europa.eu/

3.2. RUSSIA

3.2.1. METAMORPHOSE

METAMATERIALS ORGANISED FOR RADIO, MILLIMETRE WAVE, AND PHOTONIC SUPERLATTICE ENGINEERING

The main scientific objective of this Network is to develop new types of artificial materials, called metamaterials, with electromagnetic properties that cannot be found among natural materials. The results of this development should lead to a conceptually new range of radio, microwave, and optical technologies, based on revolutionary new materials made by large-scale assembly of some basic elements (microscopic and baroscopic) in unprecedented combinations. These artificial electromagnetic functional materials are engineered to satisfy the prescribed requirements.

This case study is written as part of the IP Unilink project, and aims to learn from the reports offered by each research group. The main input for this case study is the information from the official project website and personal interview with Prof. I. Vendik conducted in December 2008. Prof. I. Vendik was the leader of the research group of St. Petersburg Electrotechnical University (ETU) and she keeps the most important materials and reports produced during the phases of the research.

Background

Electromagnetic metamaterials will play a key role in providing new functionalities and enhancements to the future electronic devices and components, such as high-speed circuits, multifunctional smart miniature antennas and apertures, high-resolution imaging systems, smart skins, and so forth. After all, these and other systems are built on substrates and superstrates whose electromagnetic response functions define the design and performance of the systems. Consider a particular but characteristic example for the applicability of metamaterials: Recently, the theoretical concept of planar perfect lenses with "left-handed" metamaterials was proposed. Such a perfect lens would enable to circumvent resolution limitations in many optical or electromagnetic systems beyond the diffraction limit. Multitudinous applications in many areas of information technology and life science can be envisaged just for this single particular example, like e.g. better imaging systems, higher capacity optical data storage systems, more compact integrated optical telecom solutions, etc. Joint research activities of this Network will include composite materials with extreme electromagnetic properties (such as "left-handed" media and materials with null-valued effective parameters), electrically controllable materials, stop band materials, metageometries like fractals and quasi-periodical structures, artificial surfaces and sheets.

Choosing *ETU* as a partner for a research collaboration between European institutions was absolutely not adventitious:

"Our partnerships with many participants of the project had begun more than 10 years ago. We had many scientific publications in international journals and conference's reports, and we did know each other well before the project was started."

Research Consortium

- Helsinki University of Technology (Finland) (COORDINATOR)
- Universidad Del País Vasco / Euskal Herriko Unibertsitatea (Spain)
- Ecole Polytechnique Federale De Lausanne (Swiss Federal Institute Of Technology)(Swiss)

- University of Southampton (United Kingdom)
- Bilkent University (Turkey)
- St. Petersburg Electrotechnical University (Russian Federation)
- University of Roma Tre - Department Of Applied Electronics (Italia)
- Università Degli Studi Di Siena (Italia)
- Université Paris-Sud (France)
- University of Siegen (Germany)
- Centre National De La Recherche Scientifique (France)
- Université Catholique De Louvain (Belgium)
- The Queens University of Belfast (United Kingdom)
- Chalmers Tekniska Högskola Ab (Sweden)
- Institute of Electronic Materials Technology (Poland)
- Universitat Politecnica de Catalunya (Spain)
- Foundation For Research and Technology (Greece)
- Universidad Pública de Navarra (Spain)
- Universitat Autónoma de Barcelona (Spain)
- Loughborough University (United Kingdom)
- Thales (France)
- Warsaw University (Poland)
- University of Glasgow (United Kingdom)

Intellectual Property Issues

At the start of cooperation IP issues was not considered:

"We signed a contract with the typical paragraph about IP, and newer before and after this question was not appear."

"Probably other participants had some IP issues in the project, but they kept silence. Actually we (Russian team) hadn't encountered any IP problems"

Activities

At the beginning participants agreed all activities should in common. The activities result was a Common European Research Platform and a Virtual Institute to plan and organize joint research and use and disseminate knowledge.
The Network cooperation of participants generated a common research platform in this research field, formed and shaped an international research community working on common or closely related projects with coordinated goals to meet the following scientific/technical/educational objectives:

- To discover new physical phenomena and establish modeling methods.
- To develop novel synthesis technologies.
- To demonstrate metamaterial-based devices for microwave and optical applications.
- To identify the limitations and merits of these technologies.
- To develop new characterization techniques and measure the physical properties of metamaterials.
- To develop efficient and systematic approaches to implementation of these technologies in components/subsystems for practical applications.
- To transfer the technologies to industries.
- To train students in multidisciplinary metamaterials research.

Funding

The METAMORPHOSE project was financed by the EU Sixth Framework Programme, with a total of 4,400,000 Euros. The Russian partners did not have any problems with payments and financing of trips during the project works.

Reserved Material

Unfortunately, there is no final report of the METAMORPHOSE project at the open sources. This entailed the biggest problem for the Unilink Russian research team, because the main part of the Intellectual Property Issues, aroused during the project was out of investigation.

Reference

Interviews

Prof. Irina Vendik – the member of the METAMORPHOSE research group, who has kept the most material formed during the research activities. The personal interview was conducted on the 22nd of December 2008.

Webpage

http://www.metamorphose-eu.org/

3.2.2. MINIGAS

MINIATURISED PHOTOACOUSTIC GAS SENSOR BASED ON PATENTED INTERFEROMETRIC READOUT AND NOVEL PHOTONIC INTEGRATION TECHNOLOGIES

This case study was written as part of the IP Unilink project[99], and aims to highlight some important conclusions learned from a research project involving an EU and a Russian partner. The main input for this case study was an interview with dr Pentti Karioja conducted on Monday 9th March 2009, as well as the project website[100] and information on MINGAS available on the Internet[101]. Dr Pentti Karioja is the project coordinator - Technical Research Centre of Finland (Valtion Teknillinen Tutkimuskeskus - VTT). VTT is a non-profit-making research organisation and the biggest multitechnological applied research organisation in Northern Europe.

Background

An incentive for setting up the consortium was the research on High-sensitivity gas sensors measure, which has a wide range of applications and the development by the Finnish SME Gasera a MEMS based mechanism for detecting the pressure waves created in a photo-acoustic (PA) cell.

99 T The IP UniLink project aims to study R&D cooperation trends between Higher Education Institutions in the EU and BRIC countries. It also looks at IP management issues in such collaborations. The project is financed by the EC Erasmus Mundus program.

100 http://fp7minigas.openinno.fi

101

Thanks to the earlier personal contacts established during a previous cooperation project, the first contact with the potential partners was established by VTT, as an initiator of the cooperation and the project coordinator. As confirmed during the interview, the partners of the projects cooperated with each other before within the framework of few projects not co-financed by EU but carried-out under the bilateral agreement with Russian partner.

The cooperation was formalised in the form of a Consortium Agreement (CA), as a legal tool commonly used in the projects realised under EC Framework Programmes.

The consortium

MINIGAS project is a consortium conformed by:

- Valtion Teknillinen Tutkimuskeskus (Technical Research Centre of Finland)(COORDINATOR)
- Gasera Oy (A spin-off company from the University of Turku) (Finland)
- **A.F. Ioffe Physical-Technical Institute of Ras (Russia)**
- Qinetiq Limited (United Kingdom)
- Doble Transinor AS (Norway
- SELEX Sistemi Integrati SPA (Italy)
- Honeywell Romania SRL (Romania)
- Turun Yliopisto (Finland)

Activities

The consortium led by VTT is aimed at building and demonstrating a miniaturised sensor sub-system that achieves two or three orders of magnitude better sensitivity than other optical measurement methods could achieve at similar package volume, as well as lower cost and wider temperature range of operation. In addition to greenhouse gases, the sensor will also be able to detect explosives vapours and chemical agents such as nerve gases, when integrated in homeland security sensor systems. Moreover, it could have broader consumer benefits such as improved air conditioning in buildings[102].

Funding

The total budget of the project is 2,77 mln €. The main source of funding is EC 7 Framework Programme, from which comes 1,85 mln €. The rest of the project budget are the partners own funds. All partners financially contributed to the project, including the Russian partner - A.F. Ioffe Physical-Technical Institute of RAS.

Communication

Even that consortium partners come from the different parts of Europe, the consortium paid a lot of attention of personal meeting being one of the main mean of communication and dissemination project information. Additionally video conferences are used for this purpose. An e-mail communication and phone as means of standard communication are also used by project partners.

Intellectual Property Issues

From the moment when the original cooperation agreement was written, Intellectual Property (IP) issues were considered, including "*every aspects of IP like: ownership, costs of protection, future commercialization*". The IP clauses have been included in the Consortium Agreement. Moreover,

[102] New Technology For Detection Of Greenhouse Gases, ScienceDaily (Oct. 28, 2008), *http://www.sciencedaily.com/releases/2008/10/081028132102.htm*

following the coordinator initiative, standard IP clauses have been developed accordingly. In order to manage project IP results and to settle the IP issues more effectively, the Exploitation Committee has been established where all partners have their representatives.

So far in the operation of the project, most results are protectable by copyright, as well as secret know-how, protectable by non-disclosure agreements. Additionally, the technology brought into the project by one of the partners (private company) will be protected by a patent. Currently, there are three PCT patent applications pending relating to this technology. The patent protection is sought both in Europe and Russia.

In terms of the IP results generated by the projects itself, it has not been settled yet who becomes the owner of IP rights but, possibly, it will be all the partners of the project. The owner of the patents granted for the technology mentioned above would be the partner who invented the technology before joining the consortium.

The cost of protection of IP results generated by the project will be covered by all participants, according to the CA and decision of the Exploitation Committee

Depending on the outputs of the project and the decision of the Exploitation Committee, all available ways of IP commercialisation will be considered, including ventures, licences, etc.

According to an interviewee, awareness and knowledge of handling IP issues in Russia Higher Education Institutions can enhance the degree of cooperation. It also can contribute to more successful outputs of the cooperation "because the IP is the one of the most important factors in the project and proper management of IP determines the project cooperation"

Hinders and Supports

In the opinion of interviewee, in terms of management of project, so far there were no problems or legal, cultural or other barriers

Future cooperation and trends

The project partners are open for the future cooperation. There are plans for cooperating with Russian partners and some project are considered in the future, but any new project is not specified yet.

According to the general impression of the interviewee, based on the experience with MINGAS, future cooperation in higher education and research in Russia and the EU will increase, but the detailed reasoning for foreseeing such trend cannot be specified.

References:

Interview

PhD Pentti Karioja, project coordinator, Technical Research Centre of Finland. The telephone interview was conducted on the 9th March 2009.

Webpage

http://fp7minigas.openinno.fi

Internet sources:

MINIGAS Brochure:
http://fp7minigas.openinno.fi/bin/download/Main/WebHome/MINIGASbrochure.pdf

MINIGAS Press Release:
http://fp7minigas.openinno.fi/bin/download/Main/WebHome/PressRelease.pdf

New Technology for Detection Of Greenhouse Gases, ScienceDaily (Oct. 28, 2008),
http://www.sciencedaily.com/releases/2008/10/081028132102.htm

3.3. INDIA

3.3.1. ASSIST

COMPREHENSIVE APPROACH TO UNDERSTAND STREPTOCOCCAL DISEASES AND THEIR SEQUELAE TO DEVELOP INNOVATIVE STRATEGIES FOR DIAGNOSIS, THERAPY, PREVENTION AND CONTROL

The ASSIST project is the first comprehensive approach to understand streptococcal diseases and aims to contribute towards solving a major health problem in India. Streptococcal infections affect around 600 million people annually, according to experts. A streptococcal infection may initially cause nothing more than a relatively harmless sore throat, but it can have potentially harmful complications too. Among these are the so-called *invasive illnesses* which destroy cells and tissue, as well as rheumatic fever, which often leads to cardiac damage. Rheumatic heart disease progresses very dramatically and occurs primarily in children. Of the 15 million children worldwide suffering from rheumatic heart disease, six million alone live in India[103]. The main objective of the ASSIST project is to develop a test that will allow a quick diagnosis of streptococcal strains with potential to cause serious disease. With an effective test, doctors could concentrate on these cases, and administer proper antibiotic treatments in poor countries.

This case study was written as part of the IP Unilink project[104], and attempts to illustrate an example of successful collaboration in a research project involving an EU and an Indian partner. Telephone and personal interviews with some of the key partners have been the main sources of information for this case study[105]. Additional data and figures were obtained through several follow-up emails, the content of the ASSIST project and the EU CORDIS websites.

Background

Prof. Gursharan S Chhatwal, from the Helmholtz Centre for Infection Research in Braunschweig, Germany is the coordinator of the ASSIST project. In 2005 he initiated the first contacts for this project

[103] The Helmholtz institute issued a press release on March 2007 entitled "Quick Test to Protect Children from Heart Disease" providing details on the rationale behind the ASSIST project.
[104] The IP-UniLink project is co-financed by the European Commission's Erasmus Mundus Programme, under Action 4 'Enhancing Attractiveness'. The project aims to study R&D cooperation trends between Higher Education Institutions and Research Institutes in the EU and BRIC countries, including an analysis of IP management issues in such collaborations.
[105] A complete list of interviews can be found in the reference list

with all participating centres. Born in India, Professor Chhatwal had first-hand knowledge of the Indian research community and was familiar with the situation of neglected communicable diseases in that country. In fact, he had had long term associations with some of the Indian partners. One of them was with the Christian Medical College in Vellore, India, that had been working with Professor Chhatwal in several previous collaborative research programmes during the previous 8 years. The other European partners knew each other from international conferences and the exchange of published information in their fields, but had never worked together in a research project before.

Professor Chhatwal built the consortium aiming to form an inter-disciplinary team and looked for both, clinician and molecular epidemiologists that could be good contributors to this comprehensive research. Scientifically, later on each partner would become leader of one of the work packages based on their expertise.

Ahead of the proposal, an initial two-day planning meeting was held in Braunschweig, Germany with the attendance of all the partners. The specific research objectives were discussed in depth. Other project's aspects considered were the plan of action, the role of each participant institution, timeline and the required funding for the project. The Helmholtz Centre for Infection Research acted as host for this meeting, and made its extensive experience submitting EU applications available to the partners. One of the European partners stresses that the Helmholtz office *"knows what the EU wants to hear, and it has become an expert in applying for EU funding."* An Indian partner recalls that many aspects of the collaboration were clarified to those partners that *"were not very familiar with EU projects."* The centre provided administrative support and advice to formulate a detailed research proposal. Its support would be fundamental to handle the contracts later on. Mechanisms to protect patentable results arising from the collaborative research were discussed in subsequent communications. Each partner made sure that all the documents and agreements signed were in compliance with their institution's regulations. Two of the interviewed partners admitted that when they got involved in the project, they focused on the scientific part and, when it came to deal with contracts, they basically *"just got the information on what and where to sign."* Indeed, all the interviewees appreciated this support and expressed their reluctance to spend much time and resources dealing with all the administrative paperwork associated with the initial application.

In addition, Professor Mehra, from the All India Institute of Medical Sciences, and Professor Chhatwal met at an international medical conference, and had an additional intensive planning meeting. They discussed some of the specifics of the Indian partner's involvement in the project and the training of young Indian researchers at the Helmholtz Centre.

The Project

The ASSIST project started on the 1st of January 2007 for a duration of 36 months. It is funded by the 6th Framework Programme of the European Union. The project meets specifically the objectives of the Priority Area "Specific measures in support of international cooperation" and is relevant to activity code INCO-2004 A.1.3 "Knowledge and technologies to improve control of neglected bacterial diseases which are an important problem on the regional scale and do not include malaria, AIDS and tuberculosis".[106]

The kick-off meeting took place in February 2007 in Chandigarh, India, hosted by Professor K.K. Talwar, from the Indian Postgraduate Institute of Medical Education and Research. Scientists representing all partner institutions attended this first meeting, including all scientist directly responsible for ASSIST completion, and scientists specifically appointed for the project or involved in the project activities at different levels. It presented an opportunity to discuss in depth all the components of the project, especially issues concerning transport of biological material under the rules of each country.

[106] More information on the 6th Framework Programme of the EU and the projects founded by FP6 can be found at the website: http://ec.europa.eu/research/fp6/index_en.cfm

Goals

The primary objective of the ASSIST project is to "*apply a multi-disciplinary approach to understanding the spectrum of streptococcal diseases in India. A novel diagnostic test for rheumatogenic streptococci will be designed and candidates for development of region-specific group A streptococcal vaccines prototypes will be identified*."

The specific objectives are:

1. Epidemiological studies in defined areas in North and South India
2. Genotyping of virulence strains obtained during the survey and expression profiling of representative strains
3. Elucidation of nature and mechanisms of invasive diseases in India in comparison to European surveillance data
4. Identification of genetic markers that contribute towards susceptibility to streptococcal infections in the two ethnically defined Indian populations
5. Validation of the induction mechanisms of acute rheumatic fever in the Indian scenario
6. Rational design of a fast diagnostic test for the identification of streptococci capable of causing rheumatic fever based on the structural biology of collagen recognition
7. Identification of candidates to develop region-specific vaccine
8. Communication of relevant information, transfer of technology and knowledge on new biotechnological approaches to governments, decision makers, international agencies and health authorities.
9. Training of young Indian scientists in the modern methodology established at the European partners' institutes

Partners

There are six partners in the project, three from European and three from Indian universities and research institutes:

- Helmholtz Centre for Infection Research, Braunschweig, GERMANY (Coordinator)
- Postgraduate Institute of Medical Education and Research, Chandigarh, INDIA
- Christian Medical College, Vellore, INDIA
- Karolinska Institutet, Stockholm, SWEDEN
- All India Institute of Medical Sciences, New Delhi, INDIA
- University of St. Andrews, UNITED KINGDOM

Dr. Nirmal Kumar Ganguly[107] is the project's advisor in India, and has attended several of the consortium meetings. There are other senior scientists with whom the partners have discussed the project and who also have attended some of their meetings.

Funding

The entire project at all 6 centres is being supported under the European Union's 6th Framework Program, with a funding of 1475000 EURO. In addition, each individual institution is providing infrastructural and staff support at different levels.

The Consortium Agreement

The cooperation was formalized as per the guidelines and objectives of the 6th Framework Programme of the European Union. A contract covering all the major management issues and the partners' roles and responsibilities was drafted, circulated, and signed by all the partners. It included a confidentiality agreement and clauses on intellectual property, payments, publications and handling of internal

[107] Dr. Ganguly is currently the Director-General of the Indian Council for Medical Research, and has been President of India's National Academy of Medical Sciences.

disputes among others. As indicated before, The Helmholtz Centre for Infection Research handled the initial contracts based on standard documents used for EU funded projects. A material transfer agreement was later developed and signed by the partners.

Activities

The various objectives of the project were broken down into realistic deliverables and work-packages to be completed within stipulated time frames at each centre. The following activities are being performed complementing these roles:

- Annual meetings:
    - February 2007 annual (kick off) meeting in Chandigarh, India
    - June 2008 annual meeting in Braunschweig, Germany
    - 2009 annual meeting: to be held in October in Germany

  These gatherings have been attended by professors, students and staff employed by the project. They have been especially important to deal with logistic issues, shipping of samples and timing. Additionally, some partners have met and spent time discussing the ASSIST project at other symposia and international conferences in the medical research field.

- International Miniworkshop: **The Negative Side of Gram-positve Bacteria, *October 2007,*** Mararikulam, India.

- Exchange of staff and students among participant institutions, mainly focused on the training of junior Indian scientists in the modern methodology established in Europe[108]. Some senior scientists have also travelled to other centres to share their expertise.

- Publications: some of the partners have or are in the process of producing individual publications related to their own data and experiments. To date, there are no joint publications but they are expected by all the interviewed partners. Since the final objective is to design a clinical diagnostic tool for the Indian partners, when this is achieved (probably after the project is finished) Indian partners will text the diagnostic test and this will produce an important joint publication.

- Website: www.helmholtz-hzi.de/en/assist/home/

- Annual reports on the project's progress

Communication and dissemination

Most of the correspondence and communication in the project is mediated through email and regular post, with material and biological samples being exchanged via courier and air mail. The collaborating teams have been getting together for regular assessment of the project at conferences, meetings and symposia. On top of it, regular monthly and annual reports of achievements are disseminated among the participant centres through email and post.

Novel research findings are starting to be disseminated by the partners at international and national conferences and through publications in high impact peer reviewed journals. Besides these standard channels for publicity, the partners are also "*planning to pursue the circulation of data to key target groups, such as health protection agencies, the pharmaceutical industry, medical councils, academia, and the general public*." However, the Consortium agreement delays this dissemination until the findings generated are protected or until it is certain that the diffusion of generated knowledge will not affect the protection of the results.

[108] This constitutes one of the formal objectives of the project: "Training of young Indian scientists in the modern methodology established at the European partners' institutes"

The ASSIST project has a website, hosted by the Helmholtz Centre, which describes the rationale behind this project, partners' expertise and activities, project's objectives, scientific publications, and press releases and news. It also has a password-protected restricted area that provides the partners with aims and results of the project, and it is designed to speed up communication between them. Some of the interviewees admit that this website is not very interactive and that they very rarely check it.

Intellectual Property Issues

<u>IP in the ASSIT project</u>
Intellectual property (IP) issues were considered and discussed from the start of the project. There was a consensus among the partners that agreements concerning IP should be established before the research began. The consortium agreement included an IP component covering:

- Ownership of pre-existing know-how and the knowledge produced by the project
- Access rights to information generated by the project
- Protection of results capable of commercial application:
    - entity filing for protection,
    - entity covering the costs associated with the drafting, filing, prosecution, granting and maintenance of the IP,
    - entity responsible for legal actions against infringers
- Exploitation and beneficiaries from patentable results.

As defined in the proposal, the findings of the project would contribute towards the implementation of measures for diagnosis, prevention, control and treatment of streptococcal diseases in India. All the partners interviewed for this case-study acknowledged the progress of the project and were convinced that it will achieve its objective of producing a patentable clinical test to be used in India. It was planned in the contract to patent the usable results by utilising the services of an external patent agency or lawyer. Once this is done, "*it would present tremendous opportunities for Indian small and medium enterprises to undertake further development to control streptococcal diseases."*

<u>IP in International Research Collaboration</u>
The interviewees agreed that it was extremely important to them that the ASSIST contract managed cooperation on all levels and defined IP issues very clearly from the beginning. One partner stressed that *"it was needed to protect all parties involved",* while all appreciated the great coordination and initial planning that made this agreement "easy". In this kind of collaborations with many participants involved, "*it would be a failure if some of the partners holdback their results fearing that they won't be credited for their findings."*

One of the European partners expressed that IP agreements can be tricky when institutions and multiple countries and legislations are involved. Therefore, *"most European universities have developed IP ownership policies and established legal departments with IP expertise and support*." They provide assistance when the researcher's findings are ready to seek intellectual protection.

While the interviewees considered IP issues very important, they all concurred that it is not their main concern when engaging in these international research collaborations. "*Scientists do research for advancement, and not just for getting patents."*

Finally, one partner reflected on the challenges that patents present to researchers. The need to protect results with patents often significantly delays the dissemination of research. During the very long procedure involved in applying for it, "*you cannot share as much and you cannot talk as much about your results which, in a way, goes against research and advancement of research. At the same time, the patents are required in order for the findings to become attractive on the market. So it can also be viewed as the reverse: it is an obligation for the scientist to really make sure that your findings are useful*."

IP in India

The European partners consulted for this case study confessed a lack of knowledge on how IP issues are handled in India. As one of them puts it, "*this was never a factor when I decided to engage on this collaboration.*" Also, *"it is not about which country you are collaborating with, but if you are expecting patentable results."* As stated before, the Helmholtz Centre was extremely professional in providing legal and administrative support when the contract was signed. Therefore, IP issues were well defined from the beginning. All the interviewees agreed that having this clarity can enhance and attract new cooperation. *"Once all researchers and their institutions feel protected, they can start focusing on science."* One Indian partner defends that IP agreements should always be encouraged; *"there has to be some kind of trust if you are part of a collaborative group. There must be transparency.*" According to this researcher, the Indian government encourages collaboration with other countries. The fact that any international research project needs to be scientifically and administratively approved by different committees and ministries in India, provides peace of mind to international partners. *"If the project is approved it means that it has adequate agreements in place, including one covering IP rights."* This is corroborated by another Indian participant who defends that there has been an increase in awareness of IP issues in the last 10 years, and today "*India has very strict rules on IP rights."*

Hinders

The three main barriers found by the partners are the level of bureaucracy in India, the lengthy reporting in EU projects and the policy and schedule of payments:

Indian Bureaucracy

The main difficulty for the Indian partners was the unexpected delay they faced in obtaining approvals and licenses from their national governing bodies for the exchange of biological samples/material with their collaborators. In India, all international collaborative studies have to comply with guidelines for transfer of biological material formulated by the Ministry of Health and Family Welfare. "*Any international collaboration requiring biological samples to be taken out of the country or their exchange is possible only if a project proposal with a clear and well-documented memorandum of understanding has been approved by the Institutional Ethical Committee and the Health Ministry's Screening Committee."* This proposal requires very specific and elaborated forms. Until the proposal for the ASSIST collaboration was approved and the project got ethical clearance and a registration number, the initial money sent by the EU could not be used or any staff appointed. This happened four months down into the project. The delay affected the work of those partners whose research was dependent on the shipping of the samples from India. One of these partners, who works in another project with Indian scientists, feels that the degree bureaucracy in India interferes too much with the running of international research collaborations. In the ASSIST project this has partially been overcome "*thanks to the contacts that Dr. Chhatwal has in that country, and to the participation in the project of Dr. Ganguly as an advisor.*"

Reporting to the EU

The Indian partner interviewed *"faced no problems from the European Union in making this cooperation a success."* He agreed with the rest of the participants that the EU grants imply a huge amount of paperwork. The reporting in particular is *"lengthy and boring"* for some partners, and "*annoying"* for other. While they understand the need to report how the EU money is being used, as researchers they commonly tend to work overtime, and are not used to keep track of all the hours and activities they perform in the project. European universities and research centres often have offices that provide administrative guidance. However, those partners who lack this support find the reporting extremely difficult. One partner positively thinks that this is something you can learn and serves for future projects.

Payments Policy and Schedule

One interviewee explains that initially, when the EU awards the grant and the project starts, there is a big transfer of money to the partners. After that, the EU does not make any payment until the partners do their annual reporting. For this researcher, *"it makes you feel that the EU does not trust you anymore.*" Other funding bodies tend to send all the money at the beginning of the project, subject to *"reasonable*" annual and final reporting. This not only reduces unnecessary paperwork, but also helps the researcher in budgeting all the activities since projects have different spending rhythms during their life.

Another problem related to the funding is the fluctuation in the money received by partners located in non-euro countries and the lack of adjustment to changing local payment scales. One European partner explains that he made an initial estimate for employing an experienced post-doc during the three years of the project. By the time the project was funded there had been a 30% mandatory increase for that type of position, negotiated by unions and the university. In the end, he could only afford hiring an inexperienced post-doc for two years. This researcher worries that the quality of the staff hired may have an impact on the outcomes. He criticizes that *"the EU grant does not give the possibility to adjust for this kind of changes."* Also, with the fluctuations in the exchange rate, this partner tends to be cautious with spending to make sure that there will be enough funds. Since the participants do not receive their money until the reporting is done, it may lead to a situation in which, in the end, there is research money left that has to be returned to the EU. Again, all this uncertainty could be avoided if the total awarded money was transferred from the beginning. For this partner, "*the way the EU hands out the money is very confusing."*

The schedule of payments is an issue for another European partner because it has affected the shipment of samples. She claims that the EU money for 2008 has been received in the spring of 2009. For this partner's institution this does not represent a problem as the researcher is allowed to go temporarily *"negative"* on her account until the grant's money is received. Her institute has other resources to finance her research. "*This is not the case for some of the Indian partners. If they do not receive the EU funding on time, they do not have any other resources for their research and to pay for the shipping of the samples*." One of these Indian partners feels that the schedule of payments was not well communicated to them. He recalls that when they received the initial money from the EU in the beginning of 2007, they thought that it corresponded to the first year's expenses. Therefore, they spent it all in epidemiological studies and screenings. Given that the second instalment was not been received until very recently[109], this partner's research team suffered a *"financial crisis"*. Despite the "*very strict accounting and bookkeeping"* they have in India, his institute was able to support them for the first 3 or 4 months of 2008. After that the scientific staff went for more than 10 months without a salary, and also "*there were not funds to send the samples collected in 2007 to Europe."*

All the partners contacted for this case study agree that the EU gives them a lot of scientific flexibility to organize their work in the most convenient way for them. Also, that no restrictions are imposed on the methodology employed. *"This contrasts very much with the EU stiff, strict and picky reporting requirements."*

Supports

A summary of the factors mentioned as responsible for the success of this research consortium include:

- Initial vision to build a multidisciplinary project
- Selection of partners: *"The ASSIST project is a success in great part due to the great coordination and careful selection of partners that complement each other very well. This project had the right people to succeed, and this can be credited to the coordinator"*
- Quality of the approach: *"It brings together Indian and European expertise, encouraging collaboration with people that normally would not collaborate. Each partner brought a different expertise to the project." "This collaboration allows researchers to be exposed to other people and create networks that can lead into new projects, exchange of students and staff, conferences, etc." "The interdisciplinary approach is the way to go."*

[109] For some partners this happened in April 2009. Some claimed that this delay was caused by the back and forth emails exchange with Brussels for additional reporting clarifications.

- Meticulous planning and coordination: *"Coordination is essential for the success of the project. If there is a bad coordination, it takes a lot of energy and the whole experience turns into a nightmare."*
- External support: "*The fact that Dr. Ganguly is the project's advisor has been important in speeding up the paper work in India."*
- Cooperation and teamwork between participating centres: "*The required research demands the joint efforts and expertise of all partners. This creates a synergism and adds value to the project results."*
- Timely and effective execution of plans
- Cross pollination of ideas, and unrestricted exchange of information
- Initiative by all participating members to circumvent hurdles/difficulties
- The professional approach in managing this project: *"The coordinator and his institution have extensive experience handling EU funded projects, and from the beginning provided advice to all the partners involved."*

The Future Cooperation

One of partners of the ASSIST project anticipates a continuation and further strengthening of this cooperation. While this has not been materialized on a new proposal yet, they "*intend to carry forward the novel leads that this project has brought forth and there is promise that this would translate into new more advanced projects."* This is expected to involve those current participants who have a clinician profile. Partners working on molecular research do not envision future collaboration with the Indian partners at the moment. They feel that once the diagnostic test is produced, future projects to develop a streptococcal vaccine will require a different kind of expertise.

What is assumed by all parties is that the collaboration will definitely continue until all the findings have been published. This will probably happen beyond the next 8 months left on the project.

Finally, one of the partners reflects: *"Not only is the cooperation going to benefit higher education and research, but I also foresee with excitement, a larger benefit to humanity as a whole from the novel scientific leads this cooperation is bringing forth."*

<u>Trends</u>

The immense growth in collaboration between EU and India in the fields of transnational medical and basic research in the past few years quite clearly indicates further strengthening of ties between them. All the partners contacted for this case study foresee an increase in international collaboration in higher education and research. For the European interviewees, India has a lot of potential, especially in the bioscience field. But other countries that are not so well-known like Malaysia also have "*high quality education and important institutes of research that are very promising for collaboration"*, indicates one of the partners.

All the Indian partners consulted believe that the scientific pool, new government, technical development, clinical resources and advanced level of English in India bring nothing less than "*excellent expectations*" in future cooperation between European and India higher education institutions.

In the past few years there has been an increase in bilateral agreements for research collaboration and exchange of scientists between India and Europe, particularly with France, Hungary and Germany. This latest collaboration has been materialized with the recently created Indo-German Science and Technology Centre in Delhi, India in an effort to enhance scientific cooperation and networking between these two countries. There has been also an agreement to set up an Indian version of Germany's Max Planck Institute, consisting of a network of centres of excellence across universities and scientific institutes that already collaborate with the original Max Planck Institute.

References

Interviews:

- Dr. Vinod J Abraham is an Associate Professor of the Department of Community Health at the Christian Medical College in India. The telephone interview was conducted on the 19th of May 2009.

- Prof. Kootallur Brahmadathan has recently retired from his position at the Department of Microbiology at the Christian Medical College in India. The telephone interview was conducted on the 18th of May 2009.

- Prof. Dr. Narinder Kumar Mehra is Head of the Department of Transplant Immunology & Immunogenetics at the All India Institute of Medical Sciences. The telephone interview was conducted on the 4th of May 2009.

- Prof. Anna Norrby-Teglund works at the Centre for Infectious Medicine of the Karolinska Institutet in Sweden. The personal interview was conducted on the 8th of May 2009 at the Clarion Hotel Sign in Stockholm.

- Dr. Ulrich Schwarz-Linek is a Lecturer and researcher at the Centre for Biomolecular Sciences of the University of St. Andrews in Scotland. The telephone interview was conducted on the 16th of May 2009.

Websites:

- ASSIST Project: www.helmholtz-hzi.de/en/assist

- EU CORDIS: http://cordis.europa.eu/

3.4. CHINA

3.4.1. JORCEP

THE JOINT RESEARCH CENTER OF PHOTONICS

The Joint Research Center of Photonics (JORCEP) is a collaboration between the Royal Institute of Technology (KTH) in Sweden and Zhejiang University (ZJU) in China. It acts as a center of excellence for both its parent universities and is engaged in both research and education. The centre collaborates on PhD education and offers an international Master of Science program in photonics, mainly taught by KTH teachers.

This case study was written as part of the IP UniLink project[110], and aims to highlight some important learning from a research project involving both an EU and a Chinese partner. The main input for this case study was an internal report written by Dr. Erik Forsberg in February 2007 and two interviews with Dr. Forsberg conducted in February 2009. Dr. Forsberg was appointed Deputy Director of JORCEP when the center was created in 2003 and continued working in this position for 5 years, until 2008. Dr. Forsberg still functions as a senior advisor to the center, but his previous position as Deputy Director has been assumed by Associate Professor Gabriel Somesfalean.

Background

The idea to establish the Joint Research Center of Photonics[111] (JORCEP) was coined by Professors Lars Thylén (KTH) and Sailing He (KTH and ZJU) during the spring of 2003. At the time they had a professional relationship, working at different departments at KTH within related fields and having overlapping research interests. The choice of ZJU as a Chinese collaboration partner in photonics research for KTH was, apart from existing personal contacts, natural as ZJU represents one of the strongest centers for photonics research in China[112]. During the summer of 2003 support for the establishment was obtained from the presidents of the two universities and an agreement of establishment was drafted. The agreement was later signed by the two presidents Yunhe Pan and Anders Flodström in October 2003 during a visit of Prof Flodstöm's to ZJU.

When drafting the agreement of establishment, a decision was reached that the collaboration should not only be a research collaboration but something more comprehensive and integrated. Thus, upon establishment, JORCEP was given the three specific tasks of conducting joint research and publish the results in the name of the center, to cooperate in PhD education and to jointly run an international Master of Science program in Photonics.

Immediately after the contract for establishing the center was signed, Erik Forsberg was recruited to join the center and work with setting up the operations on site at ZJU in Hangzhou. At the same time the first application for funding was submitted (and granted).

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110 The IP UniLink project aims to study R&D cooperation trends between Higher Education Institutions in the EU and BRIC countries. It also looks at IP management issues in such collaborations. The project is financed by the EC Erasmus Mundus program.

111 The full name of the center is the 'Joint Research Center of Photonics of the Royal Institute of Technology and Zhejiang University'.

112 Since 2005 ZJU is officially ranked number one in the field of photonics in China. ZJU is also the birthplace of optical engineering in China.

The Center

JORCEP is not an actual research center in the sense that it is not a legal entity, but rather a virtual organization acting as a center of excellence in photonics for both its parent universities: the Royal Institute of Technology (KTH) in Stockholm, Sweden and the Zhejiang University (ZJU) in Hangzhou, China. The main involved departments at the respective universities are the Laboratory of Photonics at KTH and the Center for Optical and Electromagnetic research at ZJU, but also include additional laboratories at KTH (at the Department of Microelectronics and Applied Physics and the Division of Electromagnetic Engineering). At the time of creation the two universities did not have any previous experience of formally working together, but there had been a limited exchange of PhD students.

Joint research and exchange of PhD-students got off to a quick start in the beginning of 2004 and with the start of the Master of Science program in the fall of 2005 all of the three tasks had been accomplished. The center then entered into a phase of consolidation where the focus was on organic growth and the long term merging of the different research groups comprising the center into a more cohesive research organization which can utilize activities synergies of the groups' individual strengths to achieve a whole which is lager the sum of the parts.

Activities

The activities conducted by the center have mainly focused on the three main tasks; research, PhD education and a joint international Masters program in photonics. There have also been some other activities taking place such as conferences, industry cooperation, and an attempt to set up a video link between the two universities.

Research

Photonics is the science and technology of generating and harnessing light, with applications in a wide range of fields such as communication and information, metrology, health care and life sciences, manufacturing and lighting. Photonics is in a sense all around us, but is still to a large degree invisible in everyday life as it normally plays the role of a technological enabler. At the Joint Research of Photonics (JORCEP) various researches of both fundamental and applied natures are carried out within this scientifically challenging and economically important field.

Joint research got off to a quick start by choosing collaborative projects on subjects where there already existed running projects on both sides. Since then new projects have been engaged together mainly in the areas of nanophotonics and biophotonics. The main research directions of the center include optical metamaterials, photonic crystals, nanophotonics, optical networking, and during 2005 a large effort of biophotonics was initiated. To date over 142 scientific papers have been published in the name of the center[113].

PhD education

The JORCEP collaboration on PhD education is centered on student exchange, i.e. Chinese students doing part of their thesis work at KTH or vice versa. Both short-term (i.e. a few months) and long-term (1-2 years) exchange periods are common and it is the nature of the project and a few other factors that determine the time span. Long-term stays are however more frequent. To do part of the thesis work at another university is positive for a PhD student's development towards becoming a mature scientist. This is of course of great interest to JORCEP as the center strives to offer world class PhD education in the field. There is however an additional benefit of the exchange with regards to the long term success of JORCEP. This has to do with the fact that to ensure long term success, the center needs a large amount of personal contacts between the two universities and staff that is well acquainted with both universities. PhD-students who spend extended periods of time at both universities will gain a personal contact network at both universities as well as a good understanding of the ways of working of both universities. Thus the PhD-students participating in the center's exchange program act as a "glue" for the center. After graduation some of these students will remain as faculty members at either university and will be very valuable co-workers at the center.

[113] For a full list of publications, see: www.kth-zju.org

Joint Masters Program in Photonics

The planning of the joint masters program in photonics was initiated in the beginning of 2004. The plan was to base the program on an already existing program at KTH. This would significantly simplify the planning as well as ensure that the program already from the start had a well established curriculum as well as experienced teachers. The KTH program was chosen because it was already taught in English and had at that time recently become part of an Erasmus Mundus program in photonics, marking the educational quality of the program.

Thus the planning mainly concerned formal issues. What degree(s) to issue being one of these. Originally the idea was to issue a joint degree, however this turned out to be impossible due to legal issues. The choice was then to issue double degrees. Obviously, both universities' requirements for a master's degree have to be satisfied in order for double degrees to be issued. One detail here was that the KTH program was 1,5 years in length whereas ZJU required 2 years of study for a master's degree. Thus an extra semester was needed to be added onto the KTH program base. The issue of what permits was needed to run the program in China also took some time clear up and achieve. In late spring 2004 the program was ready, however by then it was too late to recruit students for the fall semester of 2004 and thus the program was launched in the fall semester of 2005.

Students in the the program spend about half their time in China and the other half in Sweden. KTH maintains control over the quality of the program and KTH lecturers teaches and examines in all courses that derive from the KTH program, even if the teaching is done in China. In some of these courses the KTH lecturer shares the teaching with lecturers from ZJU. Some local courses required by ZJU are of course taught by lectures from ZJU. When the program started in 2005 the program had 5 students. The number of students who enrolled to start their studies in the fall of 2006 had doubled to 10. The program curriculum later on went through some modifications, mainly due to the fact that master's programs at KTH changed in length to 2 years and at ZJU to 2,5 years.

Master thesis work in China

The buoyant growth in China's economy and increasing importance on the international stage both economically and politically have in recent years led to a tremendous increase in the interest in China in Sweden (and elsewhere). Students now recognize that knowledge about China can be a key competence when entering the job market, which for instance can be seen in the large increase in students interested in studying the Chinese language. Recognizing this, JORCEP, are now offering students from KTH interested in photonics to come to ZJU and do their masters' thesis. The first student began his thesis project in March 2007 and another two in September 2007.

Conferences

JORCEP has since 2005 also been engaged in organizing conferences and workshops. Besides the obvious benefits of these events in terms of scientific exchange and networking opportunities for the participants, the organization of conferences offers JORCEP an opportunity for 'name branding', i.e. to establish the organization as a well-known actor in its field. Widespread recognition of the center's existence and activities is of importance for the future in terms of e.g. securing funding and opportunities for international collaborations.

The conferences JORCEP have been involved in are:

- International Workshop on Meta-materials and Negative Refraction, Hangzhou, August 27-29, 2005.
  - JORCEP acted as co-organizer for this workshop.
  - http://www.coer.cn/973workshop/

- International Symposium on Biophotonics, Nanophotonics and Metamaterials, Hangzhou, October 16-18, 2006.

  - JORCEP was the main organizer for this symposium which was organized in collaboration with the State University of New York at Buffalo, the Chinese University of Hong Kong, the National Science Foundation of China and IEEE LEOS.
  - http://www.kth-zju.org/bionanometa/

- Asia-Pacific Optical Communications Conference, Hangzhou, Oct 26-30, 2008.
  - JORCEP is the main organizer of this conference, which is the largest in its field in the Asia-Pacific region. The conference is organized in collaboration with the Chinese Optical Society and SPIE.
  - http://www.apoc2008.org/

A conference on nanophotonics in Saltsjöbaden in 2009 in collaboration with IEEE LEOS is also planned.

Industry collaborations

With the joint center firmly established both in the sense of internal organization and in terms of recognition in the scientific community it is natural to move further to include industrial contacts into the collaboration. These are of two natures, one being technical collaborations with companies regarding R&D. In addition however, as the center represents a large amount of contacts in the photonics communities in Europe and China it is well positioned to act as a focus for contacts between Swedish/European and Chinese photonics industries, something which would be of benefit for companies on both sides. China's demand for optoelectronic products accounted for 23% of world market in 2005, a demand which is predicted to grow by at an annual rate of more than 40%.

Collaboration with industry is something which is in its initial stages as it is only after the center has been well established that it is an attractive partner for industry. At present, dialogues with several major companies are underway and JORCEP is also helping a small Swedish photonics startup to find a suitable production partner in China.

The center’s educational activities should also be of benefit for industry as students graduating from the center will, besides their knowledge of photonics, have first-hand experience of life ‘on the other side’, beneficial for e.g. Sino-Swedish industrial collaborations and for Swedish companies operating in China recruiting local Chinese engineers.

As of autumn 2007, discussions have been held with Ericsson about a possible joint research project. The partners reached an agreement in summer 2008 and signed a formal contract to conduct joint research in the area of optical communication solutions.

Spin-off company

One spin-off company from JORCEP has also been founded: Fuyang Photonics, which focus on consulting, contracted photonic device design, and contract education aiming at the Chinese market in general and the Shanghai/Hangzhou bay area-region in particular.

Funding

As with all scientific endeavours funding is a crucial issue and this has, to a certain degree, been a persistent headache for the center. Joint research projects are of course funded by research grants in the normal way. However, the center also needs funding for activities beyond core research projects, e.g. travel between the groups to establish and maintain personal contacts and financing the International Advisory Board meetings. Very little funding of this sort has been available (in effect only funding for the salary and travel costs for the deputy director have been granted) and thus funding for these activities have had to be solved on a case-by-case basis. Ways to secure long-term funding for center specific activities remains a top priority. At present the main issue in terms of funding is to secure funding to be able to increase the permanent presence of Swedish seniors and PhD students at ZJU.

At the start of the collaboration both KTH and ZJU contributed equivalent funding to the center amounting to approximately 50 000 Euros each[114]. The KTH funding was aimed at providing for Chinese PhD students to come to KTH to study and conduct research, and the funding provided by ZJU was aimed at paying for equipment. The Chinese partner also provided free facilities of 1000 m^2. This was more or less the only funding provided by the parent universities. As stated above, funding for center specific activities remains a top priority and the principal funders have been (besides the parent universities):

- Swedish Agency for Innovation Systems (VINNOVA)
- National Basic Research Program (973) of China
- Swedish Foundation for Strategic Research (SSF)

Between 2003 and 2007, JORCEP had in total received approximately 5.4 million SEK including the initial financing from the parent universities. Since 2006 JORCEP has also been annually granted scholarships from the Chinese Scholarship Council (CSC) for Chinese PhD students and post-docs to go to Sweden.

Communication

Since the center has been mainly driven by Profs Lars Thylén, Sailing He and Erik Forsberg, it has to a large extent been these three persons that have met when personal meetings have been arranged. However, due to disperse geographical working locations, i.e. Sweden, China, and elsewhere, it has not always been possible to meet in person. So a lot of the communication between the three key persons has been done through telephone conferences and emails. The center has also had an idea about installing a permanent video conference link.

JORCEP video-link

It has for some time been the desire of the center to install a dedicated video conferencing system linking KTH and ZJU. Such a system could be used for meetings of the executive group, scientific discussions between the researchers in the groups, broadcasting of various lectures given at one site to the other and for use in teaching, e.g. in the joint masters program. Besides practical uses of such a system it should also have the added benefit of creating a greater sense of belonging between the groups. One Chinese system which was available at a very limited cost (thanks to the center's contacts) has been tried, but turned out to be inadequate for international use. Several commercial systems exists, but since costs are prohibitive the project's effort to get such a system up and running have been put on hold awaiting suitable financing.

Intellectual Property Issues

Intellectual Property (IP) issues were not considered when the original cooperation agreement was written. However, an additional agreement was written at a relatively early stage covering how to deal with IP. The quality of this agreement is unclear and there is doubt whether this agreement actually would have worked very well in reality or not.

One potential issue to consider is the rules regarding ownership of research results and potential patents. In China the results belong to the university which is very different to the situation in Sweden, where the individual researcher owns the rights to the results of his/her research. So far this has not been a problem for JORCEP as most research has been basic research without much focus on applications. So, the filing for patents has for example not been an issue at all, but it is recognized as a potential difficulty for the future. Especially since the center has now entered into an agreement with Ericsson and are more likely to produce applications from their research.

It is not clear whether increased awareness of handling IP issues in Chinese Higher Education Institutions (HEIs) could enhance the degree of cooperation between EU and Chinese HEIs, and contribute to more successful outputs of the cooperation:

[114] In local currencies, KTH contributed 500 000 SEK and ZJU contributed 2 000 000 RMB.

"Possibly, the IP area is getting better in China. 20-30 years ago they didn't have anything, but now it is getting better"

"There must be countries that Sweden cooperate with (in research) that have different IP laws and regulations, and where the cooperation has been successful … so sure, you need awareness about IP in China, but if you want to cooperate you will always find a solution to these questions"

I.e. if there is an interest and need of cooperating with a Chinese partner, you will always find a solution to the IP questions.

Hinders and Supports

The following section will present some of the key hinders and supports identified during the work with driving JORCEP in China and Sweden.

While looking back at the work done to establish the center, as was done during JORCEP's 3-year anniversary party that was held in Hangzhou in October 2006, it can be concluded that it has been successful. However, it is of course work that has not been without its problems and challenges.

As mentioned in the previous section on funding, money to be used to facilitate the center's activities (e.g. for travel, International Advisory Board meetings, and communication equipment) has generally not been available. While in many cases it has been possible to work around this, it has meant that an excessive amount of time have been spent on this issue and it continues to hamper the further development of the center. Funding for the center's operational staff has also been scarce and a constant battle.

One of the key factors of success of the center's establishment is the fact that JORCEP has had, more or less from the start, a permanent Swedish presence on site at ZJU in China. However, arranging this has not been without difficulties from an administrative point-of-view. The reason is that Swedish universities, as opposed to multi-national companies, have no experience in sending people abroad as expatriates; hence no administrative routines exist to handle such cases. This is due to the traditions on exchange within the academic world. Academia is of course a very international field and scientists frequently move between many universities in various countries during their careers. Normally though, the scientist is employed locally. But this is not a feasible arrangement when collaborating with a university in a country such as China where the salaries are significantly lower than in Sweden[115]. Living costs are of course lower in China than in Sweden as well, but since a stay will not be permanent (rather on the order of a few years at the most), the Swedish scientist coming to Sweden will not be able to completely disentangle him/herself from economic commitments at home in Sweden. Furthermore, chances for accompanying spouses to find a suitable job are limited. Thus some salary from Sweden must be paid to staff being sent to work for the center in Hangzhou. Unfortunately, KTH lacks both suitable employment forms for staff placed to work in China and experiences regarding the special circumstances that apply to such staff. This has been a problem for the center. So far it has only been applicable to two KTH employees working more permanently in China and in those cases it has been possible to arrange some special solutions. These have, however, been both cumbersome and unstable and are not feasible when expanding the number of Swedish staff working in China. The problem is recognized by KTH and there exists a desire to create a viable solution, but progress is slow and this is limiting the potential growth of the center.

The organizational and work cultures differ a lot between Sweden and China. In Sweden, organizations tend to be flatter and less hierarchal. A PhD student and his supervising professor often have more of a friendship relation and they are on a similar 'level'. In China the situation is very different. The supervising professor acts as the boss of his PhD student and working relationships are more hierarchal and authoritarian:

"…cultural differences when it comes to the relationship between a professor and the PhD student. The relationship is more often of a co-worker nature in Sweden, while in China the

[115] A post-doc salary in China is in the order of 10% of the salary of a Swedish one.

> *relationship is much more hierarchal – students more generally follows the professors order without much question."*
>
> *"…if the computer gets stuck at 9pm the professor can call a PhD student to fix it! In China the boss is the boss. On the other hand, the boss is expected to take a lot of responsibility as well. They make sure to help their students find jobs, etc to a larger extent that in Sweden."*

It is important to be aware of these cultural differences when going abroad to study or conduct research in a different culture.

Other issues which have been or potentially will be somewhat problematic are related to differing rules and regulations in the two countries. One example is regarding the master's program where there are different requirements on the degree. This is, as is evident, not unsolvable but requires careful planning.

The Future Cooperation

<u>JORCEP</u>

The centre will continue to operate and the level of activity will increase in all areas, i.e. research, PhD education and Masters education. An additional Swedish partner will be added, Lund University located in the south of Sweden. The research conducted by Lund is complementary to KTH's and not overlapping, so their contribution is thought to be very important for the centre's future.

Dr. Forsberg believes that in order to strengthen the cooperation further more links between the partner universities should be made on all levels. It is dangerous to only rely on personal relationships, since the cooperation then becomes more vulnerable if a certain person leaves. In addition, to further reduce the risk for the centre it is vital to secure financing for centre specific activities.

<u>Trends</u>

After several years of working in China, Dr. Forsberg believes that it is likely that research cooperation between European countries and China will increase:

> *"I can't imagine anything else than an increase. China is investing an increasing part of their GDP in research and the GDP is increasing itself. There are many good researchers from China in other parts of the world and they do return home. They used to be bought home, but now they return on their own will"*
>
> *"There is an educational mentality in China. Too a large extent it has been focused on technology, which is not always so good from a research perspective. But those who come back from other countries have the same kind of mentality as researchers in other parts of the world. The result is that they are building up a research mentality that is not only technology focused"*

The benefits from a European point of view to work with a Chinese partner are not always so clear-cut, so it is important to think about what the motives for really are:

> *"…there are reasons for Chinese partners to work with Swedish partners – mainly technology transfer from EU to China. One can't neglect that. But it is better to cooperate than shut them out. China wants to cooperate with EU because we know something that they don't. The long term profit for KTH is a strong relationship with an increasingly important player in science. A short term profit for KTH is that, through the center, we have 30 PhDs instead of 3 PhDs. We were able to maintain research volumes that we would never had been able to have otherwise."*

Advices for setting up collaboration

This section present some advice to other Swedish and European actors who wish to set up research collaboration with a Chinese partner.

When considering starting up collaboration with a Chinese group the first thing to do is to seriously consider what you want to get out of the collaboration. Rest assure that your potential Chinese partner will have this very clear for himself/herself.

Second is to choose your partner carefully. Any collaboration, with China or elsewhere, should of course strive to achieve a 'win-win' situation in which both parties gain something from the collaboration, and choosing a partner that performs research of a comparable scientific quality helps to make this possible. In the case of JORCEP this was true and a 'win-win' situation certainly exists. When trying to break down what the gain of the different sides have been (so far) it can be said that the gain for KTH has been access to a large pool of talented students and access to the Chinese photonics community. Furthermore the collaboration has meant that KTH has been able to maintain a research volume which would otherwise have been difficult to do the given present financing situation in Sweden. Furthermore, for KTH in general, collaborations like this can act as a PR-tool to establish the awareness of KTH among Chinese students, making it easier to recruit students to KTH's international master's programs. For ZJU the collaboration has meant access to more advanced semiconductor processing facilities and techniques as well as a better access to the international photonics community.

Also try to look for a partner that has some experience with working at western universities as this will quite probably make it easier to collaborate. The fact that Prof Sailing He had worked in Sweden at KTH for many years (and still retains a position there) before moving back to China to start his group has for instance been of great value for JORCEP.

An already existing relationship of some sort with the potential partner is very valuable when starting up. This makes it more likely to achieve a consensus of the shape and aims of the collaboration.[116] A more personal relationship between the principals of the collaboration (e.g. the founders, chief scientists, co-directors) is of course very valuable when difficulties arise. If no personal relationship exists, try to build one before engaging in a more serious collaboration. Part of the success in establishing JORCEP should definitely be attributed to the good relationship between Profs Lars Thylén and Sailing He.

Make sure to recruit and send at least one European senior to China to work with the centre. This has several advantages:

- It points to a serious commitment of the collaboration, something which should not be underestimated
- It will build a knowledge for the European side of how the Chinese partner university works, how the Chinese university system works, and of the scientific community in China is the field
- It means that there is someone who, besides his/her research, continuously works with the collaboration. The principals starting the collaboration will inevitably frequently be busy with other issues than the collaboration and thus the work forward will be in danger of being done in 'bursts', e.g. the following meetings between the principals.

The success of JORCEP has partly been attributed by the fact that there has existed a permanent Swedish presence at ZJU more or less since the very beginning.

As mentioned in the section on funding, access to (long-term) money to use for center specific activities is both needed and somewhat hard to secure. If specific funding cannot be secured early on, discuss in some detail on how to finance such activities in other ways.

Make sure to get as many people as possible on both sides involved in the collaboration and make sure that personal relationships on all levels between the European and Chinese groups get a chance to be established. This will make the collaboration more likely to become successful and it will also make it less dependent on key staff.

[116] And thus avoid an all too common situation in Sino-foreign collaborations where the partners have wildly differing opinions on the nature as well as desired outcome of the collaborations, sometimes summarizedby using the old Chinese saying "同床异梦" (Same bed, different dreams).

References

Interviews

PhD Erik Forsberg – was the main operative person working with JORCEP from the start in October 2003. He continued driving the project for 5 years, until 2008. The telephone interviews were conducted on the 12th and 13th of February 2009.

PhD Zhangwei Yu – did her PhD partly at KTH and partly at Zhejiang University. She is now working closely with Gabriel Somesfalean, who is the successor of Erik Forsberg. The telephone interview was conducted on the 16th of February 2009

Internal Report

The Joint Research Center of Photonics – a brief introduction and lessons from the formation of a joint Sino-Swedish research center; Erik Forsberg, Deputy Director JORCEP, 2003-2008; Report written in Feb/Mar 2007

Webpage

http://www.kth-zju.org/

3.4.2. ENTTRANS

THE POTENTIAL OF TRANSFERRING AND IMPLEMENTING SUSTAINABLE ENERGY TECHNOLOGIES THROUGH THE CLEAN DEVELOPMENT MECHANISM OF THE KYOTO PROTOCOL

The potential of transferring and implementing sustainable energy technologies through the Clean Development Mechanism of the Kyoto Protocol (ENTTRANS) is an international research collaboration. The study was to explore how the Clean Development Mechanism of the Kyoto Protocol (CDM) could support the transfer of sustainable energy technologies to developing countries.

This case study is written as part of the IP Unilink project[117], and aims to learn from the reports offered by each research group. The main input for this case study is the final report of ENTTRANS downloaded from its official website and two interviews with Prof. Ji-Hongjiang conducted in February 2009. Prof. Ji-Hongjiang was the international program officer of *KUST*, who has kept all the most important materials and reports formed during the phases of the reseachment.

Background

On 30 August 2002, the Government of China approved the Kyoto Protocol. China had already been a Party to the UNFCCC since 5 January 1993. According to China's Initial National Communication on Climate Change to the UNFCCC, population growth, increasing urbanization, changing patterns of economic development and consumption, technological progress, and

[117] The IP Unilink project aims to study R&D cooperation trends between Higher Education Institutions in the EU and BRIC countries.

changes in forestry are the principle factors behind the future development of GHG emissions in China. It is stated that, on the one hand, GHG emissions will grow due to an increase in economic activity, but, on the other hand, the growth rate in GHG emissions could be reduced through technological development and the Government's strive for sustainable development.

Cause of much attention and interest having been paid to sustainable development and environment protection in China since 1990, when *Joint Implementation Network*(the coordinator of the ENTTRANS program) sent an email to Prof. Deng Gang, dean of the Department of Foreign Affairs of *Kunming university of science and technology (KUST)* , to invite *KUST* to join the program, and *KUST* immediately expressed commitment.

Choosing *KUST* as a Chinese collaboration partner is adventitious to some extent:

"*As I remember, our University had never cooperated with Joint Implementation Network (JIN) and we did not know each other well before. Prof. Deng Gang had once met some person from JIN at an international meeting. When JIN initiated the program, they sent us email.* "

Research Consortium

Foundation JIN	The Netherlands
University of Edinburgh	UK
Asian Institute of Technology	Thailand
Public Power Corporation	Greece
Tel Aviv University - ICTAF	Israel
National Technical University of Athens (EPU-NTUA)	Greece
Intermediate Technology Development Group East Africa	Kenya
Cambio Climático y Desarollo (CC&D)	Chile
Energy Delta Institute	The Netherlands
Kunming University of Science and Technology - Faculty of Environmental Science and Engineering (KUST)	China

Intellectual Property Issues

IP issues were ignored when *KUST* entered into the program contract, because the IP protection ideology was lacked:

"*There may have some IP issues in the project, but they were unconspicuous, actually we hadn't encountered any IP problems or barriers, and what we considered a lot is how to avoid technology divulgence related to national secrets*"

"Yes, some IP items included in the contract downloaded from EC's website is offered by JIN."

Actually, when interviewee was questioned, his response was not so quick and he needed look at the program agreement, then he could give us the answer:

"*There indeed have IP items in the agreement"*

Even though ENTTRANS is a basic research which itself will not lead to patent or trademark issues, it is clear that there are also some potential IP issues such as:

·Who owns the copyright, if the program contract had not specified?

·If the results need to be opened by uploading on the internet, does it require all partners' consent or special authorization?

·How long will these results be protected by copyright law?

·How to keep the know-how and avoid divulgence?

·Could the large number of original data collected by the consortium through questionnaire get some type of protection according to copyright law or other legislation?

However, those potential issues have not occurred during the whole period of cooperation. It is not clear whether enhancing the awareness of IP could help with the cooperation and bring out more successful results.

Activities

At the beginning of agreement reached, consortium agreed that this program is a pure research one, each partner take its own responsibility to finish distributive job of the program.
The objective of ENTTRANS was to analyze how transfer of sustainable energy technologies to developing countries could be supported through the Clean Development Mechanism (CDM) of the Kyoto Protocol. The approach chosen by the consortium was to explore the potential role of the CDM to help potential host countries develop a strategy for sustainable energy technology transfer and implementation. With the above in mind, the following main activities were carried out:

1. Identify for five case-study developing countries, using a questionnaire, energy service needs and priority technologies to meet those needs;
2. Analyze implementation chain circumstances for these priority technologies in the case-study countries by, among others, assessing technology implementation blockages and incentives; and
3. Analyze how the CDM could help in accelerating low-carbon technology transfers by supporting the improvement of technology implementation chains in CDM host countries.

Funding

The ENTTRANS is financed by EC through *EU SIXTH FRAMEWORK PROGRAMME*. Consortium had got 694,540 Euros in total. Funding is a crucial issue to *KUST*. Although *KUST* had got 40,460 Euros in total, the part of program taken by *KUST* was divided into five sub-projects, and each sub-project could only get 80,000 Euros in average. Sub-project group take all its efforts to save money, e.g. travel to aimed province for data-collecting by railway. (railway is a cheap way for travelling in China) and contact foreign partner by email instead of dialing international subscriber(it is very expensive to make an international phone call in China).

Reserved Material

The biggest problem Unilink Chinese research team met is there is no written report about the whole research phase of ENTTRANS and what issues occurred during the period. The material and data available is limited. The main information our team could obtain based on how much the interviewee could remember:

Reference

Interviews

Prof. Ji Hong-jiang – the member of the ENTTRANS research group, who has kept the most material formed during the research activities. The face to face interviews were conducted on the 11th and 14th of February 2009.

Final Report

The final report of Promoting Sustainable Energy Technology Transfers through the CDM: Converting from a Theoretical Concept to Practical Action – a specified introduction about the ENTTRANS and Results of it downloaded from official website on the 16th of February 2009.

Webpage

http://www.enttrans.org/

3.4.3. CILIA

CUSTOMIZED INTELLIGENT LIFE-INSPIRED ARRAYS

Sensory systems based on arrays of hairs occur widely in nature and function in diverse sensing scenarios, for instance in air and in water. CILIA (Customized Intelligent Life-Inspired Arrays) is a research project with the objective to identify the common principles underlying the widespread use in nature of arrays of mechanical sensory cells for the extraction of meaning under adverse conditions and to make those principles available for design of engineered systems.[118]

This case study was written as part of the IP UniLink project[119], and aims to highlight some important learning from a research project involving both EU and Chinese partners. The main inputs for this case study have been interviews with some of the key partners and the project's webpage[120].

Background

The project started on the 1st of September 2005 and is largely financed by the European Commission's 6th Framework Programme (FP6). The eight partners (see list of partners on next page) constituting the driving consortium had experience from cooperating with each other from before through the research projects CICADA and CIRCA (financed by FP5).[121] There was a common interest for continuing working together, so a proposal was created and submitted to FP6, who decided to approve and finance the 4 year project.

The Project

In this section we will present the project in some detail and go through the goals, partners, financing, communication, and activities that form part of the CILIA project.

118 http://www.cilia-bionics.org/

119 The IP UniLink project aims to study R&D cooperation trends between Higher Education Institutions in the EU and BRIC countries. It also looks at IP management issues in such collaborations. The project is financed by the EC Erasmus Mundus program.

120 See reference list

121 Information on the CICADA and CIRCE research projects can be found through the EU CORDIS research data base, http://cordis.europa.eu/

Goals

The goals of the project are to look for general algorithms that can be found in nature – to detect fluid and air flow – and specifically to study various arrays of hairs. The model systems of the research are the following:

1) Cerci of crickets – crickets have very sensitive organs that are able to detect very low noise levels. The crickets use this ability to be able to, for example, detect and avoid spider attacks.
2) Lateral line system of fish
3) Auditory systems of bats

The expected outcome of the project is to use the knowledge gained when designing man-made or man-mediated systems, i.e. systems to be used for detecting objects in the surroundings.

Partners

In the original proposal there were 8 partners involved. A ninth partner, the Technological University of Munich was added to the consortium later on.

Partner	Country
Forschungszentrum Jülich	Germany
University of Antwerp	Belgium
University of Reading	UK
University of Southern Denmark	Denmark
University François-Rabelais	France
University of Twente	Netherlands
University of Bonn	Germany
Shandong University	China
Technological University of Munich	Germany

Table 35 - Consortium partners of the CILIA project

Funding

The main part of the funding comes from the European Commission (EC) through the FP6. However, the program requires that each partner of the consortium co-finances part of the budget. The total cost of the project amounts to 7 773 179 Euros, and the funding provided by the EC amounts to 5 825 000 Euros, which corresponds to 75% of the total project cost. The co-financing of each partner has been solved in different ways, but most of the partners co-finance from their own budget by having staff spending time on the project. This is common practice for most EC financed projects.

The consortium agreement

The consortium has an agreement that was signed by all partners. The basis for this agreement was a standard agreement that FZ Juelich normally uses for this kind of cooperation projects, but it was slightly adapted to better fit this specific project. Besides stipulating the roles and responsibilities of each partner, it also included an Intellectual Property (IP) component which we will address in a later section.

Activities

The CILIA project is a pure research driven project, where all partners conduct both research on their own and joint research with other partners of the consortium. Some of the activities that the consortium has conducted include:

1) a project webpage; www.cilia-bionics.org
2) joint publications[122]
3) an international workshop in 2008 with 80 participants. About 60% of the participants were CILIA members and the other 40% were external stakeholders.

[122] A complete list of these publications can be found at: http://www.cilia-bionics.org/publications

The consortium is also planning for a conference that will take place in Dresden, Germany, in October 2009 on the topic 'Natural and Biomimetic Mechanosensing'. This will be a public conference with about 100-120 participants.

Considering the nature of the project – focusing on basic research – it is not surprising that the focus of outputs and results have been publications. Some individual partners have created applications however, based on the joint research results developed by the consortium. But these applications are the sole property of the partner who developed them and the specific partner make the decision of if and how to protect and exploit the application.

Communication and dissemination

The main way of communicating in the project has been through email. The consortium uses emailing lists to manage the communication between the different partners. There are 3 different types of mailing lists that are being used, which are based on different groups:

1) project management group – taking care of all the coordination, administration, and management issues
2) steering group – monitoring the ongoing work in the project
3) working groups – there are many different working groups consisting of two or more partners conducting joint research and publications

There is also a project webpage divided into a public section and a private section. The public section provides information on the objectives of the project, a list of publications made by the consortium, planned activities, contact information to the partners, etc. The private section contains discussion pages and forums.

Telephone and video conferences have been used to communicate, but are more the exception than the rule:

> *"Telephone and video conferences are difficult. Between two persons is of course the best. Between three or four is difficult, but ok if required"*

All in all, emailing is the one mean of communication most commonly used within the CILIA consortium.

Intellectual Property Issues

When the consortium was created in the autumn of 2005, all partners signed a contract for their participation. This contract also included an Intellectual Property (IP) component covering joint inventions, applications of patents, regulations of access rights, etc. The consortium arranged a workshop on IP so that everyone could get a general understanding of IP and be aware of issues and opportunities that could arise. The final contract was then reviewed by the legal departments of all partners before being approved.

So far no inventions, applications, products, processes, etc. have been developed jointly by the consortium, so there have not been any 'case' where the consortium has had to deal with IP issues:

> *"No problems yet – at the moment we are still so far from commercialization that I don't see it as a problem"*

Some individual partners have developed such applications, but in those cases it is the property of that partner and they themselves decide how to go about when seeking for protection:

> *"There are partners in our consortia that have created applications and inventions, but in those cases it is really their own developed products"*

And, in those cases it will also be the specific partner who will bear the costs of protection and make the decisions for if and how to exploit or commercialize it. If a joint invention should be discovered or created by the consortium, then the contract signed by all partners would stipulate who the owner is, who will bear the costs of protection, and what the process is for deciding about if and how to exploit or commercialize it.

<u>IP in China</u>

When being asked if they believe that increased awareness of handling IP issues in Chinese Higher Education Institutions (HEIs) could enhance the degree of cooperation between EU and Chinese HEIs, and contribute to more successful outputs of the cooperation, the interviewees replied:

> *"It helps. I don't think it will enhance, but if someone is afraid of cooperation with China because they are not sure how IP will be dealt with – then that is a problem and consequently training in IP will help"*
>
> *"I am not sure if that would affect research collaboration between universities in EU and China – if companies were involved it surely would – but between universities, I think it is mostly personal contacts that decide whether there will be a cooperation or not"*
>
> *"Personally I would never check the IP clauses in a Chinese partner university in order to decide whether I should cooperate with the person and university or not – it would be a research based decision – different for companies though – then it would probably matter a great deal more"*
>
> *"For projects that have as a goal that there should be an application as a result – then IP would be essential – yes – but if it is a pure research project then I don't think it would be a big issue"*
>
> *"Very uncertain. I don't think it will enhance cooperation, but it is a good thing. China is more active regarding IP then people in Europe think"*
>
> *"It will probably contribute to more successful outcomes – it will not affect it in a negative way at least."*

The conclusions that can be drawn from this, is that IP is not seen as a big issue for many researchers. Interviewees believe that it is never negative to raise the awareness of IP in China, but it would not be decisive in terms of whether or not a research cooperation project between Universities would be created.

Hinders and supports

The CILIA project has been very successful in many ways, but as with most scientific endeavours not without some bumps and challenges along the way.

<u>Hinders</u>

The project experienced a difficulty already during the proposal stage. Considering that the consortium was applying to the EC for funding, the incorporation of a Chinese partner was not straightforward. The EC was simply hesitant to why they should give EU money to a non-EU partner:

> *"…very hard to motivate to the commission what the contribution was of the Chinese partner. They wanted to know what they get from the money invested. 'Why pay money to China? What does the EU get back?'"*

This is of course a valid question to ask, and one that had to be addressed by the consortium. During the proposal stage, the coordinator called frequently to the EC asking questions about what to do to help and solve the situation. He believes that the resistance from the EC was probably not China-specific, but rather a lack of experience on the EC side of how to handle this issue. Now that the EC has the experience of financing a Chinese institution, the rules for how and when it is valid to do so ought to be clearer, making it an easier process next time.

As mentioned earlier, the consortium decided to incorporate a ninth partner in the project – the Technological University of Munich, Germany. At first, the consortium considered doing an open call for a new partner. But, since they knew exactly what competence they needed and that the University of Munich could meet the competence criteria defined, they decided against the idea of an open call. In order to get the EC to accept this, the consortium had to spend a lot of time debating with and convincing the EC of why they should accept, which finally succeeded.

Another obstacle, which still was not resolved by the time this case study was written (February/March 2009), is a conflict between one of the Chinese partners and an EU partner regarding the sharing of research data. The Chinese partner is afraid that data might disappear outside the consortium and is therefore unwilling to share it. According to a couple of the interviewees, this is not a China specific problem either (in fact, the researcher is European from the beginning), but rather due to researcher pride and 'fear' of loosing ownership or recognition of research data. Hence, it is on a personal level and not a country or institution level. It is an issue of great concern for the consortium however, and one of the more serious problems that have arisen during the project. One interviewee expressed that you come across this tension about sharing research results in all research communities, indifferent to the country or context. And the only way to overcome it is by establishing trust among partners through positive experiences and by always giving full credit to the source. Another interviewee pointed out that it has to be established on a legal level what research data should be shared, by whom, and what may be done with the data, i.e. it should be clearly stated in the IP agreement and signed by all partners.

One interviewee also mentioned a field trip to China, where it was difficult sometimes to get access to certain areas. But he was not sure whether it was due to his team being foreigners or that access was restricted in general to these areas.

Supports

When asked about what the success factors have been for the CILIA project, all interviewees pointed out the multidisciplinary team working together. Physicists, chemists, engineers, biologists, etc. all bring their own competences to the table and together the team achieves great results:

> *"All these groups can do their work apart, but a true collaboration is more than the sum of all parts, and we have seen great results in our projects when these different groups have put their competences together"*

And the collaboration between the various groups was also pointed out as key to success:

> *"Of course each of the individual partners has to conduct high-quality research. You can have some failures, but usually if the collaboration is really good, you solve the problem. Individual contributions have to be high quality, but it's the collaboration that needs to be there to have real success"*

> *"We have very good collaboration. It is bilateral and trilateral (within the consortium) and it really leads to new approaches, new results and new insights – collaboration really works and it brings added value"*

To conclude, the key factors of success for the CILIA project have been the mix of multidisciplinary teams all bringing specific competence to the consortium combined with great collaboration among these teams.

Future Cooperation

The CILIA project will most likely not continue in its current form, i.e. as a consortium of nine partners. But several new projects will be created as a result of the joint research cooperation. One example of such a project is the ChiRoPing, which is a new EC financed project (FP7) aimed at studying the eco-locations of bats. While the CILIA project research studies give more of an overview of bats, this new project will select a limited number of species and go more into detail. Two of the partners of the CILIA project are part of this new project – University of Southern Denmark and University of Antwerp.[123]

More 'spin-off' projects have been formed as well by other partners belonging to the CILIA consortium. So the project has been fruitful in the sense of new collaborations and projects being formed, where parts of the original consortium will continue to work together according to shared interests and priorities.

[123] More info on this project can be found at: http://www.chiroping.org/

Trends

All interviewees believe that research cooperation between EU and China will increase in the future, and that in fact, it is crucial for it to increase from a European point of view. China and India are investing heavily in both education and research and Europe should try to accompany and cooperate with them rather than compete. The fact that an increased number of Chinese students are going to Europe for their education and training (and vice versa), European companies are moving parts of their operations to China (not only manufacturing, but also product development), and that the quality of Chinese research and education is improving, make it inevitable to increase the amount of cooperation between Europe and China:

> *"… many well educated people (in China) – so eager and driven – sometimes in EU we have a problem finding good students so we have to cooperate with China and India"*

> *"A lot of Chinese students are coming to Western universities, and a large percentage return back to China. Many of them will take with them all the contacts they created – and the networks they built up while staying here will lead to increased cooperation"*

> *"In my university we have a Masters program in transportation sciences, and we have a big harbour with lots of connections with large harbours in Singapore and China. Lots of students are coming here and taking this Masters and then going back – trade is definitely one area of increasing importance, even if it is temporarily going down because of the international crisis"*

> *"The level of quality of research being done in China is rapidly increasing. China is giving a lot more freedom to researchers now – so the amount will go up"*

> *"Everyone sees the advantages by cooperating"*

However, it is a bit harder to envisage in which research areas the increase will take place:

> *"No I don't see any particular area that is highlighted. Both societies are driven by problems of the future so public funding goes into these areas. Perhaps China need to do more in environment, and Europe has already done a lot in environmental sciences. So in this area we can work together – but not really any particular area"*

> *"I think the cooperation will increase in all areas, haven't seen any specific area which might increase more then the others, or any one which will decrease"*

To sum up, all interviewees believe that it is both necessary and inevitable that research cooperation will increase between the EU and China, and that both sides will benefit from it. But it is hard to identify in which research areas the cooperation is likely to increase more than others.

References

Interviews

Prof. Andreas Offenhäuser – works at the Institute of Thin Films & Interfaces at FZ Jülich in Germany and is the coordinator of the CILIA project. The interview was performed over telephone on the 10th of February 2009.

Prof. Dr. Herbert Peremans – is a researcher at the University of Antwerp in Belgium and one of the main partners in the CILIA project. The interview was performed over telephone on the 13th of February 2009.

Zhiwei Zhang – works at the School of physics and microelectronics at the Shandong University. The interview was performed over telephone on the 20th of February 2009.

Project Website

The project has its own website where additional information can be found on the objectives of the project, publications made by the consortium, planned activities, contact information to the partners, etc. For more information, visit: http://www.cilia-bionics.org/

4. SOURCES AND LINKS

- Council of Europe, Committee of Ministres: Recommendation No. R (2000) 8
  of the Committee of Ministers to member status on the research mission of universities
  (Adopted by the Committee of ministres on 30 March 2000, at the 705th meeting of the Ministers' Deputies)

- Expert Group Report on Role and Strategic Use of IPR (Intellectual Property Rights) in International Research Collaborations, Final Report - April 2002, EUR 20230
  http://ec.europa.eu/research/era/pdf/ipr-eur-20230_en.pdf and Asia Pacific Intellectual Property Rights

BRAZIL

- Cordis: www.cordis.lu
- EuroStat: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL
- DGs = the European Commission's Directorates General involved in R&D cooperation activities: DG Research, DG Environment, DG Enterprise, DG Agriculture, e.t.c.
- NCPs = National Contact Points of the European Commission in EU countries and associates states: http://cordis.europa.eu/fp7/ncp_en.html and FP7 contacts in third countries: http://cordis.europa.eu/fp7/third-countries_en.html
- BRAZIL-EUROPEAN UNION STRATEGIC PARTNERSHIP - JOINT ACTION PLAN, 2nd Brazil - European Union Summit, Rio de Janeiro, 22 December 2008, http://ec.europa.eu/external_relations/brazil/index_en.htm
- CIRAD - http://www.cirad.fr/en/le_cirad/cirad_monde/pays.php?id=209
- European Commission Treaty Offices database - http://ec.europa.eu/world/agreements/searchByCountryAndContinent.do?countryId=3853&countryName=Russia
- European Research Advisory Board, 'International Research Co-operation' Final Report 2006; EURAB 05.032
- Federal Foreign Office - http://www.auswaertiges-amt.de/diplo/en/Laenderinformationen/01-Laender/Brasilien.html
- Nuffic - http://www.nesobrazil.org/dutch-organizations/programma-nuffic-capes/programma-nuffic-capes
- UK-Brazil Science and Innovation - http://www.reinounidopelaciencia.com.br/parceria/en/index.html

RUSSIA

- European Commission Treaties Office Database - http://ec.europa.eu/world/agreements/searchByCountryAndContinent.do?countryId=3853&countryName=Russia
- Federal Department of Foreign Affairs (Switzerland) - http://www.eda.admin.ch/eda/en/home/reps/eur/vrus/embmos/ruemed/scipro.html
- ftp://ftp.cordis.europa.eu/pub/fp7/docs/icpc-list.pdf
- Helmoholtz Association of German Research Centres - http://www.helmholtz.de/en/research/co-operations/international_projects/promoting_young_scientists_on_an_international_level/helmholtzrussia_joint_research_groups/

- Klaus Pendl, European Commission, DG Information Society and Media International Relations, ISTOK.ru Information Event, Moscow, 4-5 2007.
- Richard Burger, Science Counsellor Delegation of the European Commission to Russia: EU-Russia science co-operation: Where are we?, *Information & Brokerage Conference on Information & Communication Technologies in the EU FP7,* Moscow, 28.10.2008
- Russian Foundation for Basic Research - http://www.rfbr.ru/eng/default.asp?doc_id=6137
- Russian Foundation For Basic Research - http://www.rfbr.ru/eng/default.asp?doc_id=6368
- Scenarios for a Coordinated Approach to Sustainable Science & Technology Co-operation with the Eastern Neighbours of the EU - http://www.increast.eu/_media/Brochure_Scope_East.pdf
- Swiss National Science Foundation - http://www.snf.ch/E/international/abroad/scopes/Pages/default.aspx
- The Netherlands Organisation for Scientific Research – http://www.nwo.nl/subsidiewijzer.nsf/pages/NWOP_5V6B7Q_Eng

INDIA

- Danish Agency for Science, Technology and Innovation - http://en.fi.dk/news/denmark-and-india-expand-collaboration-on-biotechnological-research-1
- Department of Scientific & Industrial Research - http://www.dsir.gov.in/tpdup/ittp/ittp.htm
- Embassy of Italy in New Delhi - http://www.ambnewdelhi.esteri.it/Ambasciata_NewDelhi/Menu/I_rapporti_bilaterali/Cooperazione+scientifica/Accordo_di_cooperazione/
- Embassy of Italy in New Delhi - http://www.ambnewdelhi.esteri.it/Ambasciata_NewDelhi/Menu/I_rapporti_bilaterali/Cooperazione+scientifica/Accordo_di_cooperazione/
- EPSRC - http://www.epsrc.ac.uk/ResearchFunding/Programmes/Energy/Intro.htm
- IFCPAR - http://www.cefipra.org/aboutcentre.htm
- Research in Germany - http://www.research-in-germany.de/coremedia/generator/dachportal/en/06__Regions_20in_20Focus/Indien/Indo-German_20Science_20and_20Technology_20Centre.html
- S&T International Co-operation, Department of Science and Technology (India) - http://www.stic-dst.org/what.html
- MINISTRY OF SCIENCE AND TECHNOLOGY
  - International Science and Technology Cooperation: http://dst.gov.in/about_us/ar07-08/int-st-cop-proj.htm
  - DST Scientific Institutions & Professional Academia http://dst.gov.in/about_us/ar07-08/dst-inst.htm
- EU-India Trade and Investment Development Programme (TIDP): http://www.delind.ec.europa.eu/en/eco/tidp.htm
- The EU-India Grid Project Joining European and Indian grids for e-science: www.euindiagrid.eu
- An EU-India Strategic Partnership: http://www.mea.gov.in/onmouse/EU-Indian.pdf
- European Business And Technology Centre (EBTC) In India: http://www.euroindiaresearch.org/index.asp
- Euro-India ICT Co-operation: http://www.euroindia-ict.org/
- EU-India Collaboration: http://www2.spi.pt/euroindianet/links4.htm

CHINA

- Agris - www.ovid.com
- Chinese Science Citation Database
- Compendex – http://www.engineeringvillage2.org.proxy.lib.chalmers.se/controller/servlet/Controller?CID=quickSearch&database=COMPENDEX
- CORDIS – Community for R&D Information Services - www.cordis.lu
- Environmental Science Database – www.ovid.com
- Environmental Sciences & Pollution Management – http://www.csa.com/factsheets/envclust-set-c.php
- E-print Network – http://www.osti.gov/eprints/

- ❖ EUROSTAT – http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL
- ❖ Faculty of 1000 Biology – http://www.f1000biology.com/home/
- ❖ Faculty of 1000 Medicine – http://www.f1000medicine.com/home
- ❖ Information Technology Case Studies – http://csaweb111v.csa.com.proxy.lib.chalmers.se/ids70/quick_search.php?SID=816s5o489t9vbvppfet0fvgni2
- ❖ Inter Science – http://www3.interscience.wiley.com.proxy.lib.ch
- ❖ Life Competence – http://www.lifecompetence.eu/index.php
- ❖ Mechanical engineering abstracts – Illumina – http://csaweb111v.csa.com.proxy.lib.chalmers.se/ids70/select_databases.php?SID=484adilmf9a5jdm4hhus3l5qf7
- ❖ PubMed – http://www.ncbi.nlm.nih.gov/sites/entrez?db=PubMed&itool=toolbar
- ❖ RIPORTAL – European Portal on Research Infrastructures' Services – http://www.riportal.eu/public/
- ❖ Science Accelerator – http://www.scienceaccelerator.gov/
- ❖ Science direct- Fuel and Energy Abstracts – http://www.sciencedirect.com.proxy.lib.chalmers.se/science/journal/01406701
- ❖ Swedish Governmental Agency for Innovation Systems – VINNOVA – http://www.vinnova.se
- ❖ The Cochrane Library – http://www3.interscience.wiley.com/cgi-bin/mrwhome/106568753/HOME?CRETRY=1&SRETRY=0