ERAWATCH COUNTRY REPORTS 2012: Argentina

ERAWATCH Network – UNU-MERIT

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Executive Summary

Argentina is a vast country with a population of 41.1 million inhabitants in 2012 and a GDP per capita (current prices) of €8,457 in 2011. R&D intensity in the country reached 0.65% in 2011, compared to the EU27 average of 2.03%. The private sector financed about 24% of GERD in 2011. The national responses to the financial and economic crisis have not involved austerity measures towards R&D or innovation policies. In fact, and although important and consistent budgetary increases were observed in Argentina since 2003 (341% in Euros between 2003-2012), R&D intensity is far from reaching the 1% GDP goal which was originally due to be met by 2010, and remains below the regional average (0.67%). The goal of increasing BERD to 50% of GERD has not been met so far. In fact, there is a declining trend in BERD/GERD in the same period. BERD has dropped consistently from a maximum of 34% in 2004 to 26% in 2011. GERD increased by 134% in 2007-2011, mostly pushed by an increase in government spending in R&D (by 152% in Euros). This increase implied, in turn, an upward trend in the part of GERD that is financed with public funding, reaching 74% of GERD (from 69% in 2007). The recently published National Plan of Science, Technology and Innovation 2012-2015 effectively postpones the achievement of this objective (50% of BERD) for 2020. In terms of its regional importance, Argentina accounts for 7.3% of the total GDP of Latin America and the Caribbean, it is responsible for 6.4% of the region's R&D and has 22% of the total research personnel (head count) in 2008.

Research cooperation between the EU and Argentina dates back to the 3rd Research Framework Programme (1990-1994) and both parties have signed an S&T cooperation agreement and agreed on a roadmap for the period 2010/2011 for the Scientific and Technological Cooperation between the EC and Argentina. Results on the country's participation in Framework Programmes confirm the encouraging upward trend since FP5.

The science and technology system in the country experienced important changes in recent years through modifications in the regulatory system and in its institutional set up. These shifts started in 1996, with the creation of the National Agency of Promotion of Science and Technology (*ANPCYT*). This new decentralised institution was conceived to separate the promotion of science and technology by introducing competitive funding from the execution of research as such, traditionally concentrated at the R&D centres of the National Council for Scientific and Technical Research (CONICET) and other thematically specialised research performers.[1] Later on, the enacting of the Law 25,467 in 2001 - National Science, Technology and Innovation Law (known as "Framework law"[2]) - implied the creation of institutions representing the provinces and the different ministries of the federal government and their specialised R&D organisations in the processes of design and assessment of new policies and in the definition of national and regional research priorities.

[1] Read more:
http://www.vinctec.uner.edu.ar/talleres/Material%20complementario/Modulo%203/DEC1660.pdf
[2] See template:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0001?tab=template&avan_type=policydoc&country=ar

In 2007 the upgrading of the Secretary of Science and Technology (i.e., the agency in charge of science and technology policies at the federal government level) into the current Ministry of Science, Technology, and Productive Innovation (MINCYT) represented a major institutional evolution and it is a proof to the priority that the government has placed on technological development. MINCYT also fostered a policy change from an exclusive emphasis on horizontal instruments towards more sectoral policies and the selection of strategic technologies to be supported via newly established promotion funds. Specifically, a combination of specific technologies (ICT, biotechnology and nanotechnology) and sectors (Health, Energy, Agro-Industry and Science for Social Inclusion) has been selected.

The knowledge triangle is not fully operative in the case of Argentina. Although some coordination instances (such as the Scientific and Technological Cabinet, GACTEC) have aimed at increasing the dialogue and cooperation between the different agencies, only limited success has been achieved. As a whole, the education and research parts are significantly better developed and achieve more progress than innovation.

Policy practice in the form of separate ministries has created own objectives and ways of intervention on the different components of the triangle. In particular, the practice of competitive and performance-based funding is becoming the standard intervention in the promotion of R&D and innovation (via MINCYT and ANPCYT); block funding is the norm in research that concerns university employees. Similarly, although current low numbers of Science, Technology, Engineering and Mathematics (STEM) professionals are a bottleneck and thus a boost of their numbers needs to be fostered, the education and training side has ignored the industry needs in the formulation of curricula at the higher education institutions.

Hence, in parallel to the increasing budgets and efforts of research and education (677% in AR $ between 2003 and 2011, 378% in Euros), more emphasis is needed to create bridges and reinforce the triangle. Knowledge demand remains the weak factor, despite significant and generous incentives. Policy is emphasising this priority yet without visible changes in terms of outcomes and impacts.

Knowledge Triangle.

	Recent policy changes	**Assessment of strengths and weaknesses**
Research policy	Research policy • Establishment and consolidation of MINCYT • Creation and operation of FONARSEC and other sectoral funds • New medium-term National Plan of R&D • Platform to foster collaboration through sharing use of large equipment and datasets	• Continuous increases in federal budget for R&D. • Decreasing participation of private sector. Poor reaction to incentives, mostly related to productive structure • Setting of explicit quantitatively goals in terms of R&D (GERD, BERD, number of researchers and regional concentration). However, most of the goals are behind schedule (and postponed)
Innovation policy	Innovation policy • Increase role of FONARSEC and other sectoral funds • Newly created funding sources and instruments to promote the creation of technology based ventures.	• Promotion of establishment of R&D groups in firms via the provision of post-doctoral fellowships; • Still weak interactions between different types of agents and poor demand for knowledge in the private sector; • Limited (although increasing) number and quality of researchers in the private sector • Lack of adequate funding and instruments

		promoting the creation of intangible assets; • Infant venture capital industry and poor emphasis on academic spin-offs.
Education policy	Education policy • Establishment of undergraduate scholarships in STEM fields; • Establishment of postgraduate scholarships in STEM fields abroad; • Establishment of schemes to promote short-stays and "sandwich" PhDs	• Continuous expansion of scholarships at the postgraduate level by CONICET. • Increasing restrictions in terms of investment in equipment and infrastructure, reducing the endowment of equipment measured by research personnel; • Lack of adequate research performance-based incentives limits research and educational potential of both, private and public HEIs.
Other policies	Other policies	• Establishment of international calls for R&D by ANPCYT in specific sectors. • Establishment of networks for the use of highly complex equipment and infrastructure.

Assessment of the national policies/measures

	Objectives	**Main national policy changes over the last year**	**Assessment of strengths and weaknesses**
1	Labour market for researchers	• Establishment (and possible upgrading) of a new scholarship scheme for postgraduate studies and short-term stays abroad (BecAr). • Continuous support for postgraduate scholarships in the country through CONICET; • Postgraduate fellowship programmes in firms (Doctores en Empresas);	• Continuous enlargement of the FTE research personnel including repatriate researchers • Limited number and quality of researchers in the private sector • Limited mobility of researchers between sectors
2	Research infrastructures	• Continuous support to R&D • Support to the so-called Technology Platforms Projects (PPL). PPL supports the formation of excellence centres equipped with cutting edge technology and personnel dedicated to providing highly specialized products and advanced scientific and technological services in the areas of Genomics, Stem cells, New Materials and Bioinformatics; • Instruments aimed at improving R&D equipment and infrastructure.	• Disperse investment efforts and capabilities; • Funding requires increases; • Establishment of a clear roadmap for infrastructure in specific technologies and national priorities.
3	Strengthening research institutions	• Continuous support to R&D, setting the goal of 1% to be reached by 2020 (0.94% by 2015); • Introduction of sectoral policies with specific	• Keeping the pace of the investment in equipment and infrastructure to that of the research personnel requires further funding increases;

	Objectives	Main national policy changes over the last year	Assessment of strengths and weaknesses
		priorities (in the form of call for projects) (FONARSEC and FONSOFT); • Strong prioritisation of research areas by MINCYT.	• Establishment of networks for the use of highly complex equipment and infrastructure; • Lack of adequate research performance-based incentives limit research and educational potential of both, private and public HEIs; • Funding is mostly allocated in as block funding; • Continuity of self-assessment exercises although are still limited in scope.
4	Knowledge transfer	• Importance of establishment of sectoral funds, requiring participation of private firms together with academia (in some cases in the form of "grand challenges" at the country level).	• Lack of adequate funding and instruments promoting the creation of intangible assets; • Infant venture capital industry and poor emphasis on academic spin-offs.
5	International R&D cooperation with EU member states	• No major changes. The government continues to actively support the Argentine participation in different European schemes (FP7, ALBAN, ALFA, @lis).	• Roadmap between Argentina and the EU; • Argentina is continuously increasing its participation in the EU initiatives; • Cooperation is considered a priority area by MINCYT allowing to ease constraints and promote high quality research.
6	International R&D cooperation with non-EU countries	• Growth in the number of international cooperation agreements.	• Cooperation is considered a priority area by MINCYT allowing to ease constraints and promote high quality research; • Need to further strengthen joint research (specially with Brazil) to address societal challenges; • National programmes are starting to promote foreign participation under bilateral schemes. Mostly focused on the MERCOSUR area

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1 INTRODUCTION

The main objective of the ERAWATCH International Analytical Country Reports 2012 is to characterize and assess the evolution of the national policy mixes of the 21 countries with which the EU has a Science and Technology Agreement. The reports focus on initiatives comparable to the ERA blocks (labor market for researchers; research infrastructures; strengthening research institutions; knowledge transfer; international cooperation). They include an analysis of national R&D investment targets, the efficiency and effectiveness of national policies and investments in R&D, the articulation between research, education and innovation as well as implementation and governance issues. Particular emphasis is given to international research cooperation in each country.

2 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ASSESSMENT OF RECENT POLICY CHANGES

2.1 MAIN POLICY OBJECTIVES / PRIORITIES, SOCIAL AND GLOBAL CHALLENGES

The Ministry of Science, Technology and Productive Innovation (MINCYT) announced with the launching in 2011 of the *"Building Future: Towards an Innovative Argentina. National Plan of Science, Technology and Innovation 2012-2015*" that its main objective is "the promotion of inclusive and sustainable product innovation based on the expansion, generation and exploitation of the national scientific and technological capabilities as a mean to increase the competitiveness of the economy and improve the quality of life of the population in a sustainable development framework". This objective is expressed in quantitative targets to be achieved by 2015, taking 2011 as a baseline, referred to R&D investments, endowment of researchers and geographical distribution of the research efforts. As a whole, the *Plan* places emphasis on the need to focus on specific sectors, the need to articulate further the STI system and propose network innovation, and justifies the so-called Strategic Socio-Productive Nuclei (SSPN) (Núcleos Socio-Productivos Estratégicos). In this setting, the promotion of business expenditure on R&D is considered a basic ingredient.

At the same time, *MINCYT* has identified a list of societal challenges. In this process, MINCYT clarified that the established challenges in the areas of health (especially vaccines and research on stem cells), nanotech, biotechnology and energy require the joint effort of different stakeholders both inside the country and abroad. Research and infrastructure calls in these areas require forming consortia. At the same time, the projects selected for funding are expected to receive substantially bigger funds and, as in the case of the Technological Platforms, to concentrate so far dispersed efforts. At the same time, MINCYT, has initiated a move towards R&D promotion policy that adds to the original emphasis on horizontal instruments towards a growing role for specific technologies (ICT, biotechnology and nanotechnology) and sectors (Health, Energy, Agro-Industry, Science for Social Inclusion) considered strategic.

2.2 STRUCTURE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ITS GOVERNANCE

This section gives the main characteristics of the structure of the national research and innovation systems, in terms of their wider governance.

Argentina is a vast country with a population of 41.1 million inhabitants in 2012 and a GDP per capita (current prices) of €8,457 in 2011. R&D intensity in the country reached 0.65% in 2011, compared to the EU27 average of 2.03%. The private sector financed about 24% of GERD in 2011. The national responses to the financial and economic crisis have not involved austerity measures towards R&D or innovation policies. In fact, and although important and consistent budgetary increases were observed in since 2003 (341% in Euros between 2003-2012), the R&D intensity is far from reaching the 1% GDP goal which was originally due to be met by 2010, and

remains below the region average (0.67%). The goal of increasing BERD to 50% of GERD has not been met so far. In fact, there is a declining trend in BERD/GERD in the same period. BERD has dropped consistently from a maximum of 34% in 2004 to 26% in 2011. GERD increased by 134% in 2007-2011, mostly pushed by an increase in government spending in R&D (by 152% in Euros). This increase implied, in turn, an upward trend in the part of GERD that is financed with public funding, reaching 74% of GERD (from 69% in 2007) The National Plan of Science, Technology and Innovation 2012-2015 published in 2011, effectively postpone the achievement of this objective (50% of BERD) for 2020.

The science and technology system in the country has experienced important changes in recent years through modifications in the regulatory system and in its institutional set up. These shifts started in 1996, with the creation of the National Agency of Promotion of Science and Technology (*ANPCYT*). This new decentralised institution was conceived to separate the promotion of science and technology by introducing competitive funding from the execution of research as such, traditionally concentrated at the R&D centres of the National Council for Scientific and Technical Research (CONICET) and other thematically specialised research performers.[3] Later on, the enacting of the Law 25,467 in 2001 - National Science, Technology and Innovation Law (known as *"Framework law"*) - implied the creation of institutions representing the provinces and the different ministries of the federal government and their specialised R&D organisations in the processes of design and assessment of new policies and in the definition of national and regional research priorities.[4]

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Main actors and institutions in research governance

Under the new government of Cristina Fernandez de Kirchner, on 10 December 2007 the Secretariat for Science, Technology and Innovation of Production (SECYT) was upgraded to the Ministry of Science, Technology and Innovation of Production (MINCYT). The first minister, Dr. José Lino Salvador Barañao, is an internationally recognised scientist and formerly, among others, president of the National Agency of Promotion of Science and Technology (ANPCYT). The upgrading of SECYT to full ministerial rank underlines the great importance attributed to knowledge and innovation for Argentina's future and represented a major overhaul to the system. Specifically, at the same time that the national policy towards science, technology and innovation received a major boost from this development, the new minister set out immediately to overhaul the previously fragmented S&T system in Argentina by

[3] Read more:
http://www.vinctec.uner.edu.ar/talleres/Material%20complementario/Modulo%203/DEC1660.pdf
[4] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0001?tab=template&avan_type=policydoc&country=ar

putting greater emphasis on multidisciplinary and flagship initiatives that should mobilise all social actors (multi-stakeholder).

MINCYT is responsible for the policy design on R&D and innovation via the Secretariat for Planning and Policies. Specifically, it aims at strengthening strategic sectors; it coordinates the working groups that develop the National Plan for Science, Technology and Innovation and develops prospective studies to anticipate possible scenarios and carry out strategic planning.

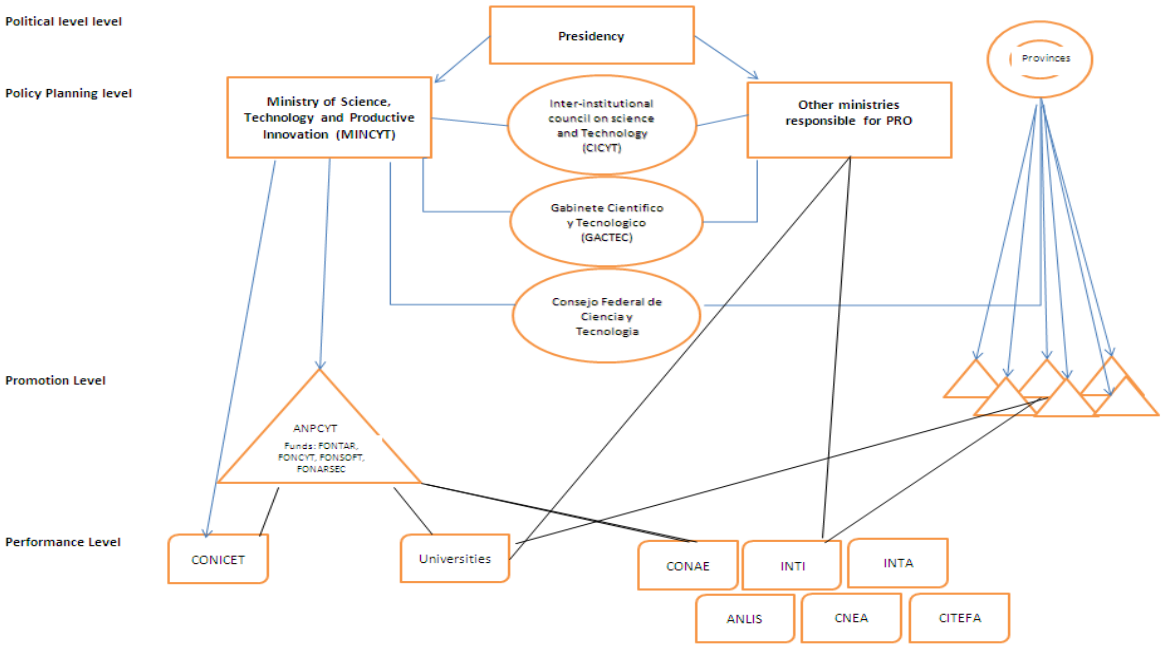
Given the variety of ministries (such as defence, production, agriculture, national planning and infrastructure, foreign affairs) and public agencies that are responsible for public research organisations, inter-institutional coordination is required and provided through the Scientific and Technological Cabinet (*GACTEC*). At the same time, the federal nature of the country implies the need to consider regional specificities and requirements in the design of policies; the Federal Council on Science and Technology (COFECYT) is taking on this task.

COFECYT is in charge of the coordination of the different levels of government (federal, provincial and local governments) in terms of policy coherence and regional equality. COFECYT, created by the *Law 25.467/2001*[5], acts as an advisory board in matters related to the articulation between national and regional (sub-national) policies and priorities. It integrates representatives of the responsible authorities in science, technology and innovation from each of the provinces and the Autonomous City of Buenos Aires.

The Inter-institutional Council for Science and Technology, *CICYT*, is the main advisory body where the key institutions in the Argentinean S&T landscape develop orientations and advice for national policy and its implementation as well as links to civil society and innovation processes and institutions. Created by the *Law 25.467/2001*, CICYT links together the public research institutions belonging to different ministries and the representatives of both public and private universities (National Inter-university Council, CIN, for public universities and CRUP, Council of Deans of Private Universities).

5 *http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0001?tab=template&avan_type=policydoc&country=ar*

Figure 1: Overview of the Argentina's research system governance structure



The institutional role of regions in research governance

Constituted as a federal country (a federation of 23 provinces and one autonomous city), the powers of the State in science and technology are located on federal and regional (provincial) levels. With the system dominated by public funding (74% of GERD), the federal government concentrates the main national policy-making bodies, direction and coordination, including the Ministry of Science, Technology and Productive Innovation (MINCYT). In the National Congress, the House of Senate and the House of Representatives have committees on science and technology whose function is to provide a detailed analysis and suggestions on legislative measures that concern R&D and innovation. At the provincial level, although all governments have the same power, only some governments have their own agencies for the promotion and coordination of scientific and technological activities. In 2010, only 4.4% of total GERD was funded by provincial governments. The most relevant examples are the Ministry of Science and Technology of the Province of Cordoba and the Scientific Research Commission of the province of Buenos Aires (CIC). The existing provincial agencies (mostly to be found in the most developed provinces) contribute with small funding (€12m allocated in the 2011 budget in the case of CIC and €5m for 2010 in the case of Cordoba). In practice, both the policy design and the promotion responsibilities are mostly addressed by the federal government.

The Federal Council of Science, Technology and Innovation (*COFECYT*), created by the Law 25.467/2001[6], acts as an advisory board in matters related with the articulation between national and regional (sub-national) policies and priorities. The members of this Council are the highest STI authorities in each of the provinces and the Autonomous City of Buenos Aires.

[6] Read more: *http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0001?tab=template&avan_type=policydoc&country=ar*

The Federalization of the National Programme of Science, Technology and Innovation programme (*PROFECYT*) was created in 2004 under COFECYT to promote and safeguard the development and activities aimed at strengthening science, technology, innovation, and knowledge transfer to society in all provinces and regions of the country. With a budget of €19.4m for a total of 910 projects (almost tripled from the slightly below €7m total in 2010) PROFECYT aims specifically at reducing the technology gap between different provinces. In addition, every year COFECYT provides grants focused on local needs of provincial government agencies, industry and civil society. To ensure a fair and balanced funding, planned COFECYT amounts are equally distributed across the different provinces. The different programmes include: Tourism Sector Technology Support (*ASETUR*, created in 2008); Municipal Technological Development Projects (*DETEM*); Federal Productive Innovation Project (*PFIP*) and Federal Productive Innovation Project - Productive Linkages (*PFIP - ESPRO*). In terms of the number of projects selected, 27 PFIP projects and 19 PFIP-ESPRO were financed for a total of €5m (€435,000 in each province). In relation to ASETUR, 39 projects were selected providing a total of €4.8 in funding (€200,000 for each province). In the case of DETEM, 53 projects were funded in 2012 (a drop compared to the number of 70 projects approved in 2011) for a total of €5.5m (€200,000 for each province). Similarly, and acknowledging the regional disparities in the country, the National Plan aims at increasing the proportion of total GERD performed at the 19 provinces with the lowest investments in R&D to reach 37% in 2020 (from 28% in 2011) (see Section 2.3.1).

Main research performer groups

Gross domestic expenditure on R&D (GERD) in 2011 amounted to about €2.23b (current prices), while R&D intensity (GERD as a percentage of GDP) reached 0.65%. The public research organisations performs the most R&D in terms of expenditure (42.1% of total GERD in 2010), followed by the higher education sector (28.2%), and business sector (22.3%).

The major research performers in Argentina include the R&D centres or joint centres with/at universities of the *CONICET*, universities, and thematically specialised public research organisations. The most important public research organisations attached to federal Ministries include: *INTA* (National Institute for Agro Technology, Ministry of Agriculture), *INTI* (National Institute for Industrial Technology, Ministry of Production), *CNEA* (National Commission of Atomic Energy, Ministry of Planning), *CONAE* (National Commission of Space Activities, Ministry of Foreign Affairs), *INIDEP* (National Institute of Fisheries, Ministry of Agriculture) and *ANLIS* (National Laboratories of Health Institutes Administration, Ministry of Health).

In what refers to the spatial organisation of research activities, the five largest jurisdictions (the Province and the City of Buenos Aires, with Cordoba, Santa Fe and Mendoza), concentrate approximately 67% of the population of the country, while bringing together over 75% of university researchers and more than 80% of the members of CONICET, accounting for approximately 78% of the total gross geographic product (GGP), and approximately 72% of the investment in R&D. For their part, the eight provinces that comprise 16% of the total population (Jujuy, Misiones, San Juan, Corrientes, Chaco, Formosa, La Rioja and Santiago del Estero), agglomerates less than 10% of university researchers and less than 3% of the researchers of CONICET (they account for approximately 7.5% of GDP and 4% of

exports). Since 2005, the National plans for science and technology explicitly included increasing the share on the nation's R&D resources in those 19 provinces outside the five largest jurisdictions just mentioned (to 37% from 28%).

2.3 RESOURCE MOBILISATION

2.3.1 Financial resource provision for research activities (national and regional mechanisms)

GERD increased by 134% in 2007-2011, mostly pushed by an increase in government spending in R&D (by 152% in Euros). This increase implied, in turn, an upward trend in the part of GERD that is financed from public money to 74% (from 69% in 2007). The recently published National Plan of Science, Technology and Innovation 2012-2015 effectively postpones the achievement of this objective (50% of BERD) for after 2015. In addition, Higher Education Institutions increased their participation (reaching in 2010 around 22% of GERD) in R&D expenditures. These trends are a by-product of a genuine expansion of the system and improvements of the wages of researchers combined with inflationary pressures in the economy.

Since 2005, several exercises of strategic planning covering both national and regional levels were implemented to serve as an orientation for the subsequent yearly and multi-annual plans established by the Law 25,467[7]. These exercises provided goals, targets and trough participatory processes and prospective studies at the same time that identified strengths, weakness and listed research priorities. The first strategy (put forward in the "Basis for a Medium-term Strategic Plan in Science, Technology, and Innovation 2005-2015"[8] and then updated in the "*Bicentennial plan*") identified four challenges faced by the country and identifies four strategic objectives that science and technology should aim at contributing to overcome them. The table below presents them:

Challenges	**Strategic objectives of the research policy**
Increase the cohesion and social equity	Orientation of R&D towards societal problems, improving the quality of life and social development
Open development paths	Creation and application of knowledge for exploitation of natural resources while protecting the environment
Articulate the national innovation system and build a new production specialisation profile	Strengthening innovation, modernisation and technological linkages in industrial production and agriculture
Advance towards a knowledge society and economy	Increase the scientific base and technological capacity

[7] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0001?tab=template&avan_type=policydoc&country=ar
[8] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0002?tab=template&avan_type=policydoc&country=ar

Taking these objectives, the "Basis" established four targets to be reached by 2015:

(a) the number of researchers will increase from 1.6 to 3 full-time equivalent researchers per thousand members of the economically active population;

(b) the total investment in R&D will reach the equivalent of 1% of GDP;

(c) private investment in R&D will increase until it is on par with public investment;

(d) the 19 provinces with the lowest investments in R&D, which accounted for about 20% of the nation's R&D resources, will double their share of the national total.

The Bicentennial Plan, published in 2006, revised the targets referred to investments in GERD and BERD and set them to be reached by 2010. In relation to the regional distribution of resources, the plan included the intermediate objective of reaching 30% of total investments by the most lagged provinces by 2010. These quantitative goals were not achieved (see below). Nevertheless, MINCYT proved its commitment with these goals, by announcing in 2011 the launching of the "*Building Future: Towards an Innovative Argentina. National Plan of Science, Technology and Innovation 2012-2015.*" This plan sets as a general objective "the promotion of inclusive and sustainable product innovation based on the expansion, generation and exploitation of the national scientific and technological capabilities as a mean to increase the competitiveness of the economy and improve the quality of life of the population in a sustainable development framework". This objective is expressed in targets to be achieved by 2015 and 2020, taking 2011 as a baseline[9].[10] The table below summarizes the stated goals:

Goal	Baseline 2011	Target 2015	Target 2020
GERD/GDP	0.65%	0.94%	1.65%
BERD/GERD	26%	36%	50%
Researchers (FTE) to 1,000 active population	2.9	3.8	5.0
Proportion of total GERD performed at the 19 provinces with the lowest investments in R&D	28%	32%	37%

As a whole, the Plan places emphasis on the need to focus on specific sectors, the need to articulate further the STI system and propose network innovation establishes and justifies the so-called Strategic Socio-Productive Nuclei (SSPN) (Núcleos Socio-Productivos Estratégicos) in the areas of agro-sector, manufacturing industry, health, environment and sustainable development, energy and science for social inclusion. In this setting, the promotion of business expenditure on R&D is considered a basic ingredient. It should be noted that the national response to the financial and

[9] Read more: http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0003?tab=template&avan_type=policydoc&country=ar

[10] The presented table describe the most optimistic scenario (labelled as Scenario B). See page 22 of the Plan.

economic crisis has not involved austerity measures towards R&D or innovation policies. In fact, there is a continuous increase in budgetary allocations since 2003.

The bulk of government spending on R&D is financed by the Federal Government. Specifically, the federal financing of S&T policy has two main channels: budgetary appropriations of sectoral ministries that fund higher education and research organisations; and budgetary appropriations of *MINCYT* and decentralised agencies (*CONICET* and *ANPCYT*). As a whole, the majority (91%) is allocated via institutional funding. ANPCYT, with a budget of €174 million in 2012 is the only source of competitive funding at the level of the Federal government. Institutional funding, mostly to Higher Education Institutions, remain the dominant form of support to R&D although impact evaluations have shown that competitive funding for R&D projects allow input and output additionally. (See more on available impact evaluations on *FONTAR* and *FONCYT*)

ANPCYT is responsible for administering the Fiscal Credit (CF) programme established by *Law 23877* (1990). The objective of the CF is to provide financing for R&D projects such as: technological modernisation projects, scientific research, pre-competitive technological research, adjustments and improvements. Instrumented through a public tender, owners of companies as individuals or legal entities producing goods and services are eligible to finance projects up to €500,000 (depending on the mechanism) and up to 50% of the total cost of the project, in the form of certificates for paying up the income tax. *FONTAR*, similar to the recent period, allocated in 2012 AR $40m (equivalent to €7.5m) of tax credit to domestic companies for conducting research and development, technological upgrading and technological counselling training. These amounts were approved for a total of 122 projects, 70% of them led by SMEs. In terms of sectors benefiting from these grants, chemicals and chemical products occupy the first place, followed by machinery and equipment, computer services and food and beverages.

2.3.2 Providing qualified human resources

One of the strategic objectives of the country is to dramatically increase the number of researchers in the next decade (from 2.9 in 2011 to 5.0 FTE per thousand of the economically active population in 2020). Recently, the country exhibited a rapid expansion observed in the ratio of researchers to the active population (the figures for 2003 and 2007 were 1.80 and 2.4, respectively) explained by the expansion of scholarship programmes and openings at the lower level of the researcher career at *CONICET* centres. In fact, in 2010, 42% of the total research personnel were younger than 40 years old. However, it should be noted that that this increase (33% of FTE in between 2006-2010) has implied new demands in terms of infrastructure and equipment that are expected to be more acute in the future.

In 2010, researchers were mostly employed in the government sector (48%), followed by HEI institutions (37%, of which 90% corresponds to public universities). Enterprises employ a slowly increasing share of researchers, reaching 12.6% (in comparison to 9.6% of the previous year) of total FTE researchers, with the remaining 2.1% working in non-profit private organisations. The shares have increased by 3 percentage points for the university sector during the past five years, while the public sector share remained unchanged. Researchers in science and technology fields show a relative stable participation in research personnel (46%). Agricultural sciences and social sciences are the two fields where some more growth of researchers can be seen.

In terms of tertiary education, the dearth of interest in Science, Technology, Engineering and Mathematics (STEM) disciplines has been a reason for concern in the recent decades. However, the most recent period start showing encouraging facts. Data for 2010 shows that STEM graduates account for slightly above 19% of total university graduates (increasing by more than one percentage point since 2006), with an almost unchanged share in relation to the new enrolments at the tertiary level (19%). At the undergraduate level, the STEM graduates increased by 26%, surpassing the 17% exhibited by the total figure for graduates (all disciplines and fields). At the masters' level, the total number of graduates increased by 65% between 2006-2010, while STEM graduates grew by 75% to climb to 12% of total masters obtained (increasing by 1 percentage point in the period). The picture for new doctorate holders is brighter than for the lower levels, showing an increase in the number of new doctorate holders per 1,000 population aged 25-34 from 0.86 in 2006 to 1.56 in 2008. Although the number of new doctorate holders is low compared to other countries, it increased by 261% between 2006 and 2010 to reach 1500. The doctorate holders in STEM fields increased by 314% in the same period to account for 51% of the total ISCED 6 level graduates (in 2006, it represented 44%).

The availability of highly skilled professionals in STEM has been noted as a bottleneck in sectoral fora and prospective studies, such as "Basis for a Medium-term Strategic Plan in Science, Technology, and Innovation 2005-2015"[11] and the sector oriented *Libro Blanco de la Prospectiva TIC. Proyecto 2020"* (White Book on ICT Prospective. Project 2020[12]) and "*Tendencias y escenarios de la innovacion en el sector agroalimentario* (Trends and Scenarios in innovation in the agro-food sector, 2020). At the undergraduate level, two different scholarship schemes (*Becas Bicentenario* and *Becas TICs*) aim at supporting low-income students, preferably coming from technical tracks at secondary schools, entering the tertiary education level in the fields of applied sciences, natural sciences and basic sciences (Bicentenario) and software (Becas TICs). These programmes provide up to 30,000 scholarships for an initial yearly amount of €1,000. The stipends are combined with tutoring and mentoring and efforts in upgrading the quality of the teaching programmes.

The most novel instrument in this policy domain is the recently announced scheme of providing scholarships abroad (*Bec.AR*). This initiative is projected to provide 1,000 scholarships to pursue postgraduate studies outside Argentina under three different modalities: specialization on innovation and science and technology management in Brazil (at Fundacion Getulio Vargas) and more recently expanded to France and Italy, master studies in the US, jointly organised with the Fulbright Commission and support for short stays. The programme aiming at encouraging undertaking masters studies in the US, has a total budget of €6.5 million, and aims to allocate a total of 100 scholarships between 2013 and 2014 (50 beneficiaries each year). The promotion of specialization studies and short stays has a combined budget of €8 million to support 500 individuals in between 2012 and 2016. Currently, the chief of cabinet ministers (JGM) and MINCYT are working on the preparation of a second phase of

[11] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0002?tab=template&avan_type=policydoc&country=ar

[12] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/policydocument/policydoc_0005?tab=template&avan_type=policydoc&subtab=&avan_fecha_fin=&country=&avan_fecha_ini=&avan_country=ar&query=&intergov=all

Bec.Ar that, financed by the IDB, will have an overall budget of €20 million.[13] At the postgraduate and PhD level, CONICET also provides scholarships to allow young college graduates from all regions to obtain doctoral degrees and postdoctoral training in different disciplines; in the case of PhDs mostly at national institutions. The scholarships are awarded as a result of an annual open competition. The number of scholarships increased from 2,400 in 2003 to 8,000 in 2010. Around 10% of the total amount is granted for postdocs. Also at the postgraduate level, the scholarship scheme of co-financing postdoctoral fellowships aims at promoting technology transfer and the establishment of formal research and development departments in companies. These fellowships have a maximum duration of 24 months; they are non-renewable. The granting of these categories of scholarship does not generate a working relationship with either party.

At the same time, and to increase the number of researchers active in the private sector[14], MINCYT put in place the *Highly Qualified Human Resource in Firms* programme. Established in 2011, it aims at strengthening the R&D capabilities of private firms by supporting the hiring of doctorate holders. It consists of providing firms with non-reimbursable contributions (subsidies) aimed at partially covering wages and social and labour contributions. Implemented as an open window scheme, operated through the Argentine Technological Fund (FONTAR), the interested companies are required to present a proposal indicating the required profile of the doctorate holder or providing the resume of the prospective candidate, being the project competitively selected. Support consists of a grant to cover part of the salary expenditures for the personnel hired to join or create RD&I departments or to perform other functions in line with their professional skills. The support decreases over time and last for three years. With a total budget of € 7million (US$ 10 million), RRHH AC targets existing firms (both goods and service sectors) or newly created technology-based companies. Each firm might benefit from up to 5 PhD holders, and will receive 13 payments a year to cover salary expenses for each of their PhDs. The first year, the firms will receive for each PhD a grant divided in 13 payments of up to € 1,500 (or up to 80% of the total costs for the firm), decreasing to € 1,200 (or up to 60% of the total costs for the firm,) in the second year and € 750 (or up to 40% of the total costs for the firm,) in the final year of the grant. The highly skilled human resources (beneficiaries of the grant) are required to hold a PhD and to be part of a scientific or technological institution or university.

Despite these improvements, the education and training side has been slow to react to the industry needs in the formulation of curricula at the higher education institutions and has not yet included aspects of creativity, communication, critical thinking or the promotion of problem solving and teamwork methods. Entrepreneurial training is not part of the university curricula (particularly absent in technical degrees or engineering studies).[15] Scattered efforts deploy by several NGOs (such as *Endeavor Foundation* and *Junior Achievement*) are aimed to promote an entrepreneurship culture at younger ages.

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[13] It is expected to be approved by the IDB in the final quarter of 2013, and to start operating in 2014.

[14] And to increase the employability options for the growing numbers of PhD produced in the country.

[15] An interesting exception is INGEmprendedores. Conceived as a pilot initiative sponsored by the Inter-American Development Bank that includes several countries in the region, it aims at promoting entrepreneurship training throughout the engineering studies curricula by means of specially tailored teaching materials, case studies and study problems. More on: *http://www.ingemprendedores.org/*

In relation to the attraction and repatriation of highly skilled professionals, MINCYT has in place the *RAICES* (Network of Argentinean Researchers and Scientists abroad) programme. RAICES is intended for strengthening the Argentinean Science and Technology capacity through linkages with Argentinean researchers working abroad, and for promoting the permanence of researchers in the country as well as the return of all those interested in developing new research or groups. The initiative was created in 2000 and re-launched in 2003. Based on the notion of "brain drain", the programme's main aim is to reduce the negative impact that the emigration of Argentinean researchers and technologists has on the country's scientific and technological capacities. In order to do so, the programme encourages the return and reintegration of those abroad into firms with technological bases, universities and research centres. The programme also promotes links between locally based researchers and professionals abroad through networks, encourages involvement in neglected areas of research, promotes Argentina's science and technology activities in other countries, and improves the quality of information in terms of the characteristics of Argentinean researchers abroad. In these matters, RAICES managed to repatriate almost 800 scientists and researchers and provided 40 César Milstein subsidies aimed for short stays.

2.3.3 Evolution towards the national R&D&I targets

The business sector is responsible for 24.3% of GERD in 2010 (out of a 26% of non-governmental funding). In the recent period (2007-2011), although BERD increased by 145% in local currency (equivalent to roughly 96% if measured in euros), its participation has declined from its maximum of 34% in 2004. Most recent estimates indicate a BERD of 0.158 of GDP (2011). The previous target to increase private investment in R&D to account for 50% of total GERD by 2010 was never achieved and it does not seem likely to be corrected by 2015 (the original goal). In fact, the recent National Plan has postponed this achievement until 2020. According to the latest *innovation survey* providing data for the manufacturing sector up to 2005 (*Encuesta Nacional sobre Innovación y Conducta Tecnológica ENIT*, INDEC 2008), the majority of R&D expenditures by the manufacturing sector are intramural (92%).[16]

Although total GERD financed by industry has dramatically increased as a whole in the recent period (343% in Euros in between 2003-2011), R&D activities have lost ground to other (non-R&D) innovation related expenditures. R&D represented in 2005 a small share of 16.6% of total innovation activities in comparison to 57% devoted to the acquisition of machinery and embedded technologies. Extramural business R&D in Argentina is limited. Although 55% of the surveyed firms reported contacts with other companies or institutions, the main partners to these linkages are suppliers or customers (44%) and companies belonging to the same economic group (19%). INTI stands out as the most often contacted research institution (24%). However, most of these reported links aimed at exchanging information rather than active cooperation in R&D activities. In this sense, 92% of firms indicated that they did not have ties with dedicated research institutions, and just over 80% mentioned

[16] After a few years without conducting an innovation survey, MINCYT together with the Ministry of Labour embarked on a new survey. So far, there are only preliminary results referred to a comparison between FONTAR beneficiaries and non- beneficiaries. Available on: *http://www.mincyt.gov.ar/multimedia/archivo/archivos/Encuesta_ENDEI.pdf*

that they do not work in conjunction with universities. Indeed, when the share of HERD financed by industry is taken as an indication for science-industry cooperation, only 0.66% was funded in 2007. The industrial share in GOVERD is equally negligible with 0.29% in 2007 (OECD- MSTI 2010).

R&D expenditures by the business enterprise sector are quite low in the country. According to the Innovation survey, the intensity of these expenditures in relation to firm turnover reaches only 0.2%, playing an important role in the size and composition of the productive sector. In terms of the policy mix, information from *FONTAR*[17] shows a predominant role of loans (74% in between 2002 and 2007) to firms in comparison to subsidies and fiscal credits. An important proportion of these credits are oriented towards investments in machinery. Fiscal credits for R&D on the other hand have decreased in importance. FONTAR allocated in 2012 €7.5m of tax credits to domestic companies for conducting research and development, technological upgrading and technological counselling training. In terms of sectors benefiting from these grants, the first place is occupied by chemicals and chemical products followed by machinery and equipment, computer services, and food and beverages. Although the available evaluations show positive effects in the beneficiary firms, the support policies require to be strengthened and require increasing the number of firms (especially SMEs) that apply and access to funding. To date, MINCYT or other public agencies do not use procurement policies to foster innovation among the country's portfolio of policies.

Since its creation in 2007, *MINCYT* fostered a policy change from an exclusive emphasis on horizontal instruments towards more sectoral policies and the selection of strategic technologies, creating new fiduciary funds for R&D and innovation on specific sectors. The newly created sectoral funds (i.e., *FONSOFT* on software and *FONARSEC* aimed at Health, Energy, Agro-Industry, and Science for Social Inclusion) were responsible for financing 30% of the total number of grants allocated during 2011, representing 27% of the total funds granted by *ANPCYT*. This money accounts for slightly less than 10% of the federal budget granted as a whole for MINCYT, the National Council for Scientific and Technical Research (CONICET) and ANPCYT combined.

The newest fund of the Agency (FONARSEC) aims at promoting development and innovation in areas which are critical for the economic and social development of the country, such as energy, the agricultural industry, health, and social inclusion, in a joint effort with the ministries which have specific jurisdiction over those areas of concern. The Inter-American Bank (*IDB*) agreed to provide a loan of US$100m (€75m) for the FONARSEC. FONARSEC is expected to disburse €30m in between 2010 and 2014. *FONARSEC* allocated in 2012 a total of €19.5m in benefits for a total of 15 projects. During 2011, FONARSEC allocated a total of €20.4m (€43.1m in 2010) in benefits for a total of 25 projects. In particular, 38% of the benefits in 2010 corresponded to the sectoral fund for the promotion of biotech, 34% for the one on nanotechnologies, 24% for ICT and 5% for infrastructure and equipment under PRIETec. Official documents state that the purpose of the Argentine Sectoral Fund (*FONARSEC*) is to develop critical capacities in areas with high potential impact and ongoing transfer to the productive sector, helping increase competitiveness and troubleshoot problems diagnosed with a view to meeting the demands of society,

[17] Read more:
http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ar/supportmeasure/support_0002?tab=template&avan_type=support&country=ar

companies, and the State. To achieve these goals, FONARSEC includes a variety of promotion instruments that focus on the creation of knowledge intensive firms (high technology industries) and promote private-public alliances for R&D. These instruments include: the Technological Infrastructure and Equipment Projects (PRIETec) aimed at expanding the operational capacity of R&D institutions (adapting the existing infrastructure and acquiring scientific equipment) to facilitate business and/or technology-based companies incubation; Training Programme for Managers and Technological Linkers (GTec) aimed at supporting the training of managers and technological linkers, which enhance the innovation and technological development capacities at companies and scientific-technological institutions; EMPRETECNO Technology-Based Companies (EMPRETECNO - TBC) aimed at promoting the development of technology-based companies in the different productive areas.

FONSOFT was established as a fiduciary fund in 2004, following the passing of the Software promotion Law -Law 25.922/2004- ANPCYT created FONSOFT. It aims at the promotion of R&D and technological upgrading in small and medium firms in the ICT sector. Specifically, FONSOFT funds (i) research and development projects aimed at the creation, design, development, production and implementation of software and programmes aimed at improving the quality of the processes of creation, design, development and production of software through non-reimbursable contributions with a maximum of €100,000 equivalent to up 50% of the total cost of the project; (ii) the establishment of new software firms and consolidation of existing ones via subsidies of up to €30,000; (iii) promotion under an open window scheme of new exporting firms through credits of up to €50,000 to cover a maximum of 80% of the full costs of the project (CREDITOS EXPORTA) and; (iv) continuing education projects designed to provide innovative and quality training to the community of Software and Computer Services (ANR-FOSOFT CAPACITACION) for a maximum of €10,000. FONSOFT has experienced an increasing demand in the recent period. Between 2007 and 2008, FONSOFT granted 317 projects for a total of €6 m. FONSOFT allocated in 2011 a total of €11.1m (almost identical to the €10.5m observed in 2010, and increasing from the €7m of 2009). In 2012, FONSOFT provided funds for a total of 402 approved projects and a total of €7m in benefits. Nowadays, sectoral funds are the backbone of the policies designed by the Secretariat for Planning and Policies of the MINCYT. As a whole, FONSOFT represented 5% of the total benefits provided and 31% of total projects approved by ANPCYT. More than half of the benefits (53%) correspond to matching grants oriented at quality improvement, development of new software products and pre-competitive R&D.

Although each funding measure previously described has specific eligibility criteria and support different stages of the innovation process and/or different types of research activities, the majority of the measures are structured around calls for projects that allow relatively easy access. As a whole, the process guarantees the high quality of the selected projects. Several criteria are used in the assessment of the projects, including an external analysis of its quality and technical feasibility, technical capacity of the executing unit and in some cases economic assessment of the project. Once external reviewers have completed the technical and financial assessments, these evaluations are passed to an ad-hoc commission that proposes whether to fund or not the proposal to the board of directors of the ANPCYT. The calls provide the possibility to establish a quality ranking (based on the above mentioned evaluation criteria) of the approved projects in order to set funding priorities in case of budget restrictions.

2.4 KNOWLEDGE DEMAND

The latest available economic information shows that manufacturing activities account for 19% of total GDP, followed by the production of agricultural production (10%). Within the manufacturing industry, the production of food and beverages is the most important activity (responsible for 35% of the total output), followed by the chemical industry (14%), automobiles (5.1%) and the manufacturing of machinery (3%). In terms of sectoral composition of R&D, the production of foods and beverages is responsible for 13% of total innovation activities by the private sector, chemical products contributes with 12% and automobiles has a share of 9%. Metalworking activities and plastics are the most important contributors to innovation activities by manufacturing firms (16.7% and 16.5%, respectively) surpassing their output share. Firms with foreign participation represented 52% of total manufacturing sales in 2004 but accounted only for 36% of total R&D expenditures (*Encuesta Nacional sobre Innovación y Conducta Tecnológica ENIT, INDEC 2008*).

MINCYT, via ANPCYT, has initiated a move towards R&D promotion policy that adds to the original emphasis on horizontal instruments towards a growing role for specific technologies (ICT, biotechnology and nanotechnology) and sectors (Health, Energy, Agro-Industry, Science for Social Inclusion) considered strategic. This focus is materialised through the creation of sectoral funds administered by ANPCYT that includes *FONSOFT* (for software and communication technologies) and *FONARSEC*. FONARSEC aims at promoting capacity building, innovative projects in the agro-sector, health and energy and science for social inclusion and the application of nanotechnology, biotechnology and information and communication technologies.

The table below presents a comparison between the distributions of GBAORD by socio-economic objective in 2003 and 2011. As a whole, the R&D increased importantly in nominal terms in both local currency and euros. Social relationships, Space, Exploitation of the Earth and Environment exhibit the highest percentage point increases in the period. Agricultural Technology and Industrial Technology are the objectives with the biggest shares.

GBAORD BY SOCIO-ECONOMIC OBJECTIVE	2011	2003	Variation in nominal terms (euros) (in %)
Agricultural Technology (R&D)	16.1%	21.9%	307.3%
Environment (R&D)	5.3%	3.5%	614.3%
Other civil research (R&D)	5.4%	4.5%	194.6%
Defence (R&D)	0.8%	0.5%	522.0%
Energy (R&D)	4.0%	4.5%	572.1%
Space (R&D)	4.6%	3.8%	698.0%
Exploitation of the earth (R&D)	4.4%	3.9%	658.2%
Industrial Technology (R&D)	22.4%	15.7%	289.7%
Infrastructures (R&D)	0.88%	0.5%	500.5%
Non-oriented Research (R&D)	8.9%	14.6%	194.6%
Human Health (R&D)	13.0%	11.3%	346.8%
Not specified (R&D)	--	--	
Social Relationships (R&D)	9.7%	1.5%	864.5%

R & D Financed by University Funds (R&D)	4.4%	4.4%	378.3%
Total (R&D)	100.0%	100.0%	378.3%

2.5 KNOWLEDGE PRODUCTION

2.5.1 Quality and excellence of knowledge production

In terms of output, Argentina produced in 2010 a total of 8,423 papers in Science Citation Index (SCI) representing a small share of 0.59% of the total production worldwide. Argentina's absolute number of SCI publications rose between 2003-2010 by 49% and its world share rose equally from 0.53%. In terms of the number of publications per 100 full time equivalent researchers decreased 31% in comparison to 2003: 12.8 were achieved in 2010 compared to 18.6 in 2003, showing a decrease in the efficiency of the system. Nevertheless, it exhibits an improvement since the lowest figure exhibited in 2007. In the same period, the number of papers per million US$ devoted to R&D fell from 8.21 to 3.75. Through Technological Platforms Projects (PPL), the high-quality groups, especially those as part of CONICET and those involved in research in the areas of genomics, stem cells, new materials and bioinformatics selected by the have benefited in the last three years from improvements in equipment. Similarly, through the *Programme of National Systems of Large Instruments and Databases*, MINCYT aimed at establishing so-called "sectoral research systems" by means of building networks of available information (i.e., datasets) and enabling access to each of the participant institutions of one of the systems to pool of research equipment. This instrument provides funding, allocated through a competitive process, to the institutions that participate in each thematic network for training of human resources, acquisition of inputs and equipment. Since 2009, 10 different systems have been created, connecting 153 research institutions, and promoting the shared used of more than 170 "large equipments", common use of 60 data repositories and access to the whole research production in the country. The created systems are focused on microscopy, magnetic resonance, high performance computation, mass spectrometry, x-ray, lasers, biological data, sea and fisheries data, climate data and research digital repository. This last system goes in line with the approval of a law (may 2012) in which it is stipulated that all technological and scientific production that received public funding should be deposited in a digital repository providing open and free access to those interested.

Patent statistics indicate that foreign patent offices are not considered part of the protection strategy mostly due to the required inventive step. In 2009, the country got 45, the same figure for 2010, and 49 for 2011 patents granted at the USPTO while 5,269 (in 2010) patents were applied nationally. The statistics from the national patent office show that only 11.7% of the applications in 2010 (12.9% in 2009) were by residents; the majority was applied by non-residents, showing a growing trend between 2006-2010 (the share of non-resident patents grew by almost 7 percentage points in the period) and confirming the importance of multinational enterprises in terms of R&D in the country together with registering inventions developed somewhere else. Between 2006-2010, while the overall applications decreased by 16%, the applications by residents almost tripled that fall, reaching -45.9%.

To address these challenges, FONTAR provides through ANR-PATENTES non-reimbursable contributions to SMEs aimed specifically at financing the preparation and filing of applications for patents and other intellectual property rights. The supported applications by SMEs might include non-profit public and private

scientific institutions. Operated on an open window cycle, the programme resources cover up to 80% of the eligible costs, i.e., not to exceed €3,500 for preparation and filing of applications in Argentina, and up to €50,000 for filing in other (IDB member) countries. Between 2010 and 2012, only €100,000 was allocated to this programme per year.[18]

2.5.2 Policy aiming at improving the quality and excellence of knowledge production

One of the weaknesses noted in the STI institutional framework is the lack of a structured system, being capable and effective in monitoring and evaluating institutions and programmes. Although a number of capacities have been developed within *ANPCYT*, they focus only on monitoring and not on impact assessment. According to the latest evaluation by the *IDB* (IDB, 2010), the roles to be played in evaluation processes by the different hierarchical levels are not clearly defined. Lastly, in comparison to more advanced innovation systems, the country does not have an agency to conduct studies in the STI field to provide input to MINCYT for the planning, evaluation, and policy-making process. These shortcomings are obstacles to the learning process and to on-going improvement of STI policies. Evaluations are nevertheless carried out, albeit not systematically. There are programme evaluations, for example on the technological funds *FONTAR* and *FONCYT*, and CICYT has the mandate to assess the results of the policies and actions implemented and deliver these to GACTEC (Article 16, *Law 25.467/2001*). This absence of a consistent evaluation framework tied to resources aimed at improving the quality of research institutions and their output is related to the fact that competitive funding based on excellence criteria is limited (only €174 million in 2012 were allocated via specific calls or open schemes through ANPCYT). Despite its small size, proposals submitted to ANPCYT are peer reviewed both at the technical and financial level. The evaluation results are passed to an ad-hoc commission that proposes whether or not to fund the proposal to the board of directors of the ANPCYT. The calls provide the possibility of establishing a quality ranking of the approved projects in order to set funding priorities in case of budget restrictions.

Aware of the importance of effective aligning institutional performance with national goals CICYT has launched a programme to assess the capacities and potential for the institutions devoted to R&D. The Institutional Assessment Programme (*PEI*) includes both internal and external evaluation of the institutions and aims at producing an improvement plan. However, the implementation of these plans is not tied to performance-based funding schemes.

CONICET is the only R&D institution with a well-developed internal evaluation system.

With 12,000 researchers distributed in 105 research institutes, 6 regional centres, and 2 service centres, its budget has tripled in the recent period to reach €336 in 2012 (an 10% increase from the €304m in 2011), its *performance assessment* system covers recruitment and promotion aspects. The evaluation of projects (especially to

[18] It should be noted, though, that the intellectual property system is perceived as the least important obstacle for firms investing in innovation activities. Only 5% believes it is a highly important factor (INDEC, 2008).

be admitted to CONICET) is based on peer reviews, national or foreign persons of recognized scientific and / or technological impact that are issued on the quality and merit, without prejudice to other instances. The promotion of scientific and technological staff is based on objective criteria collected by the institution itself and updated through its system of electronic CVs (SIGEVA). According to the National Executive Power decree 1661/96, the assessment criteria should take into account peculiarities distinct from the scientific and technological activities, as well as the characteristics of each area of knowledge, keeping in all cases the quality as the main priority. The assessment for income and career development of Scientific and Technological-CIC is founded on the opinion of the following academic juries: Disciplinary Advisory Committees and Board of Grading and Promotion. These procedures require the intervention of at least two peers, in an advisory capacity.[19]

As a means to foster research production, the Ministry of Education provides wage supplements for the personnel of those higher education institutions involved in accredited research activities within the universities (*Research Incentive Plan*). These funds are allocated on top of the block funding that HEIs receive for research by the *Ministry of Education*. In 2009, the most recent round, 30,729 applications were received for this accreditation, up from 23,540 in 2004. Currently, the programme has 32,000 faculty researchers categorized (65% of the members of the programme have full-time positions). The programme includes both a peer review assessment of both the project and individual performance. The assessment of the individual performance conducted every four years allows the ranking of researchers (currently into five categories) and pay the participants according to these categories. Additionally, each research project admitted should provide progress and final projects reports.

2.6 KNOWLEDGE CIRCULATION

2.6.1 Knowledge circulation between the universities, PROs and business sectors

The importance of circulation and exchange of knowledge produced by PRO and universities was explicitly acknowledged with the enacting of *Law 23,877*. This legal act was the basis for the Technological Linkage Units (UVTs) and enabled universities and public research organisations to form such entities. UVTs are institutions with the purpose of enabling the management, organization and administration or R&D projects. These institutions were constituted with the explicit intention of fostering technology transfer - linkages between research performers and the private sector, and to provide training and technical assistance. Taking into consideration the mandate that universities have on linking with the private sector and their region, the Secretary of University Policies of the Ministry of Education and CIN constituted *RedVITEC* in 2001. This network, formed by the 47 public universities, and seven higher education institutes and the National Inter-university Council (*CIN*) aims at sharing experiences and best practices of technology transfer, contributing to the development and professionalisation of the technology transfer areas of public

[19] CONICET stands out as the fundamental institution in terms of its productivity, responsible for 68% Argentine-based publications in 2012. Measured in number of publications indexed by year per researcher, the productivity of the members of the CICT is 0.52, higher than the national average of 0.13. This performance is especially remarkable since CONICET accounts for only 24% of the budget of the Science and Technology Sector nationwide.

universities and promoting the active participation of universities in the national science, technology and innovation policies.

Previous calls for the allocation of so-called Non-Reimbursable Contributions (ANR) by *FONTAR* granted funds for the development of technological clusters and technological poles. Also new instruments and funds by ANPCYT provided to knowledge circulation and exchange play a prominent role. Specifically, PI-TEC (Integrated Projects for Productive Conglomerates) finances - through competitive public processes - projects to encourage the development of clusters, by promoting alliance-building and collaborative work among enterprises and universities, provincial or local governments, and/or research centres. Given its integrating nature, PI-TEC seeks to improve coordination and synergies among the instruments available at *FONCYT* and FONTAR, in order to obtain a greater impact while favouring the convergence of interests and the establishment of a collective innovative dynamic. ANPCYT issues public calls for the submission of PI-TEC Project Ideas (PIs), to be presented by an ad-hoc association (AHA) including representatives of at least three key participants in the development of the productive cluster, such as representative business entities, technological entities, universities, provincial or municipal governments, or other organizations relevant to the productive cluster. Based on the recommendations issued by an assessment commission, the director of the agency selects the PIs it will support for presentation as PI-TEC projects. For the development of the project, including the drafting of a Competitive Enhancement Plan, the selected AHAs may receive support of up to €30,000.

In addition, the Argentinean Sectoral Fund *FONARSEC* (expected to disburse €30m between 2010 and 2014) provides incubators for high-tech firms at universities and provides newly created firms with managerial skills and personnel. Official documents state that the purpose of the fund is to develop critical capacities in areas with high potential impact and on-going transfer to the productive sector, helping to increase competitiveness and troubleshoot problems diagnosed with a view to meeting the demands of society, companies, and the State. To achieve these goals, FONARSEC includes a variety of promotion instruments that bring the creation of knowledge-intensive firms to the centre of the stage (high-technology industries) and promote private-public alliances for R&D. These instruments include: the Technological Infrastructure and Equipment Projects (PRIETec) aimed at expanding the operational capacity of R&D institutions (adapting the existing infrastructure and acquiring scientific equipment) to facilitate business and/or technology-based companies incubation; Training Programme for Managers and Technological Linkers (GTec) aimed at supporting the training of managers and technological linkers, which enhance the innovation and technological development capacities at companies and scientific-technological institutions; EMPRETECNO – Technology-Based Companies (EMPRETECNO - TBC) in charge of promoting the development of technology-based companies in the different productive areas.

2.7 OVERALL ASSESSMENT

Although there have been important improvements in the public budgets devoted to R&D and scientific and technological activities, the ability to mobilise monetary resources from the private sector is still very limited and is explained mainly by the size and composition of the productive sector. As such, the objectives related to the private sector are far from being realized. In this sense, the new efforts – via the

introduction of sectoral funds and specific sectoral priorities - are oriented towards fostering both the performance and diffusion of R&D on specific sectors.

However, it should be noted that the results and policies oriented to the increase of high-skilled S&E human resources, stimulated by the expansion of under- and post-graduate scholarships might contribute to stimulate demand for knowledge, but also to improve excellence in research. It should be noted that the weaknesses noted in the lack of a structured system that would be capable and effective in monitoring and evaluating institutions and programmes, weakens the efficiency of policy (re)design and impose barriers to a more collective process.

The creation of MINCYT (2007) represented a major institutional evolution and it is a testament to the priority that the government has placed on technological development. MINCYT also implied a change in focus in policy terms from an exclusive emphasis on horizontal instruments towards more sectoral policies. At the same time, the settings up of FONARSEC in 2009 strengthen the role and importance given to knowledge transfer. The promotion of interactions between different stakeholders and joint research endeavours are one of the pillars of the current S&T policy. Specifically, recent calls by ANPCYT have emphasized the promotion of alliance-building and collaborative work among enterprises and universities and research centres. At the same time, the newly established sectoral funds specifically aim at facilitating the incubation of firms and providing bridge mechanisms between the research performers and the firms.

3 National policies for R&D&I

3.1 LABOUR MARKET FOR RESEARCHERS

3.1.1 Stocks of researchers

Argentina presents a stock of 34,900 FTE researchers, equivalent to 2.9 researchers every 1000 people in the active population (2011). In 2010, researchers were mostly employed in the government sector (48%), followed by HEI institutions (37%, of which 90% corresponds to public universities). Enterprises employ a slowly increasing share, reaching 12.6% (in comparison to 9.6% in the previous year) of total FTE researchers, with the remaining 2.1% working in non-profit private organisations. The shares have increased by 3 percentage points for the university sector during the past five years, while the public sector remained unchanged. Researchers in science and technology fields show a relative stable participation in research personnel (46%). Agricultural sciences and social sciences are the two fields where some more growth in the number of researchers can be seen.

Argentina has achieved gender parity (women represented in 2010 51.2% of FTE researchers) although women are mostly concentrated at the lower levels of the hierarchy (also younger) and mostly on social and health sciences. Overall, only 28% of the researchers have earned a doctorate, while 10% hold a masters' degree.

3.1.2 Providing attractive employment and working conditions

Since 2003, the Federal government has put in place different measures to increase the number of researchers and the attractiveness of research careers (see section 2.3.2). In line with the important increases in the inputs devoted to R&D and scientific activities, wages for full time university personnel increased 200% (expressed in Euros) between 2003-2010 to reach an equivalent of 4.5 times the country's income per capita. University wages increased - since 2001 - twice as much as the average wage in the private sector. University wages are set through collective agreement negotiations between the unions and the Ministry of Education, setting common wages for the whole system.

Positions in universities are publicised and result of an open and public competition, granting renewable positions every 5-6 years. Between 2004 and 2011, the total number of university personnel increased by 27%. However, the full time model at the universities – associated with tenure and a higher likelihood to be involved in research activities - is the reality for only 10.5% of the personnel. In fact, between 2004-2008, partial semi-exclusive and shorter employment contracts increased more than the average of the whole system.

At the same time, the federal government has tried to surmount the deficiencies observed in infrastructures and in equipment. Deficiencies in physical infrastructure and equipment at research centres are severely restricting the growth of Argentina's technological capacity. The failure to maintain existing infrastructure and the near-total failure to expand capacities have led to severe overcrowding problems and made it impossible to expand centres devoted to technical excellence.

3.1.3 Open recruitment and portability of grants

Research grants are entitled to researchers working in private and public organizations in the country. Positions in universities are published and result in an open and public competition, granting the position for a period of 5-6 years. Positions in PROs and the public sector in general are less transparent. Portability of grants is

very limited in the country, being the universities (and not the researchers) who are signatories of the contracts and agreements with the funding agencies (such as ANPCYT).

3.1.4 Enhancing the training, skills and experience of researchers

The recently established *Bec.AR* scheme aims at providing support for short-term stays for researchers abroad. *FONCYT* has also opened calls for different instruments aimed at fostering specifically the increase in human resources devoted to R&D (Programme of Human Resources, PRH), although the last call was in 2007. Recent initiatives in the areas of biotechnology (BIOTECSUR, CABBIO and SIMBIOSIS) and Nanoscience and Nanotechnology (CABNN) have focused on the enhancing the training and skills of researchers in the region (mostly from Brazil and to a lesser extent other MERCOSUR countries).

In relation to the mobility of researchers, MINCYT has funded and secured during 2012 the mobility of 453 researchers to 17 countries involved in joint research projects. In addition, 17 calls (one per country) were opened for the mobility of researchers. In the same line, and aimed at promoting the circulation of knowledge and researchers, RAICES have provided 40 César Milstein subsidies for short stays to Argentinean scientists and researchers residing abroad (see section 2.3.2 for more information on repatriation policies). Argentina is also an active participant in several regional external relations cooperation programmes focused on education, science, technology and/or innovation. Among these ALFA, ALBAN and @lis should be mentioned.

3.2 RESEARCH INFRASTRUCTURES

The combination of a growing research staff and the setting of new sectoral priorities on R&D imply need demands in terms of infrastructure and equipment. In this sense, MINCYT has tried to address the need for a further equitable distribution of capacities across the country with the objective of establishing excellence centres in general purpose technologies as genomics, stem cells, new materials and bio-informatics. At the same time, MINCYT established so-called "sectoral research systems" consisting of networks of available information (i.e., datasets) and enabling access to each of the participant institutions of one of the systems to pool of research equipment. This instrument provides funding, allocated through a competitive process, to the institutions that participate in each thematic network for training of human resources, acquisition of inputs and equipment. Since 2009, 10 different systems have been created, connecting 153 research institutions, and promoting the shared used of more than 170 "large equipments", common use of 60 data repositories and access to the whole research production in the country. The created systems are focused on microscopy, magnetic resonance, high performance computation, mass spectrometry, x-ray, lasers, biological data, sea and fisheries data, climate data and research digital repository.

3.3 STRENGTHENING RESEARCH INSTITUTIONS

3.3.1 Quality of National Higher Education System

The Argentine university system is complex and comprises a variety of providers and regulation systems: 47 National Universities, 46 Private Universities, 7 State University Institutes, 12 University Private Colleges, 1 Provincial University, 1

Foreign University and 1 International University. Universities declare that their objectives include doing research, teaching and contributing to local development.

In terms of research, the public universities are a cornerstone of basic research. The major public universities (Universidad de Buenos Aires, Universidad Nacional de la Plata and Universidad Nacional de Cordoba) account for the bulk of expenditures, personnel and publications. In fact, Universidad de Buenos Aires – with over 10,000 published papers in 2010 - is the only university in the country listed among the first 100 universities in the Shanghai ranking. With a total size of slightly more than 1.6 million students (365,000 new enrolments), and around 100,000 students obtain undergraduate degrees per year, the public university complex accounts for 75% of this total. As a whole, the bulk of these degrees are in social sciences and humanities while STEM disciplines account for around 17% of the graduation. In terms of postgraduate education, slightly more than 2,500 students obtain masters degrees with only 10% of them in STEM disciplines. It should be noted that the majority of public universities are not only free of charges but do not have any admission requirements beyond holding a high school diploma. In some cases, admission exams are in place while others have an admission course (that is considered the first year of the studies). This situation is irrespective of the discipline. Argentina has achieved gender parity at the university level, with women representing 45% of new enrolments and 49% of first degree graduates. Nevertheless, while new enrolments in STEM disciplines account for 18% in the aggregate, this figure drops to 12% in the case of women. In terms of postgraduate studies, the country's university system has more slightly more than 33,000 master and 13,000 PhD students (2,600 and 937 graduates in 2009, respectively). STEM represents 17% and 52% of the total graduates at masters and doctorate level, respectively.

As a whole, HEIs account for almost 60% of the total personnel (Head Count) and around 45% of full time equivalents. The part time dedication of the researchers at the universities is a key challenge to overcome.[20] Although the private providers of higher education, constitute an important component of the system in terms of teaching, but are almost negligible in terms of research.

The National Inter-university Council (Consejo Interuniversitario Nacional, CIN) encompasses all the national public universities. CIN plays an important role in negotiating the overall block funding for the public universities as part of the budget law. Also, and in accordance with the Ministry of Education, it agrees on the formula that allows the distribution of the budget allocation to each university. In this formula the relative size (both of students and professorial body) is the main determining factor. The representative organ of the private universities is the Council of Rectors of Private Universities - CRUP (Consejo de Rectores de Universidades Privadas).

The National Commission for University Evaluation and Accreditation (*CONEAU*), established in 1995, carries out institutional evaluations of public and private management universities. CONEAU is a decentralized agency at arms' length of the Ministry of Education, Science and Technology. It was created by the Federal Higher Education Law as an autonomous organization affiliated to the Ministry.[21] Its

[20] As an indication the ratio of FTE/HC researchers for the HEIs in 2008 was of only 0.43

[21] Due to the autonomous status of the public universities, a few public universities including the University of Buenos Aires, the Universidad Nacional del Comahue and National University of Entre Rios presented habeas corpus to prevent to be governed by some aspects of the new legislation. In the case of UBA justice ruled that the university is exempted, inter alia, of the requirement to accrediting

mission is to ensure and enhance the quality of university degrees and institutions in the Argentinean university system through the evaluation and accreditation of the quality of the university programmes and degrees offered. CONEAU makes a "yes or no" decision within the passing process of both state-regulated undergraduate and graduate programmes projects. It issues recommendations about institutional projects of new state universities and about provisional functioning authorizations for private universities as well as their eventual recognition. Among its functions, CONEAU is also empowered to decide on the accreditation of private agencies for university evaluation and accreditation. Universities are entitled to perform self-assessments. However, these exercises must be complemented by external evaluations (either by CONEAU or authorized private agencies) to be made at least every six years in the framework of the objectives defined by each institution

3.3.2 Academic autonomy

Universities enjoy an important degree of autonomy, being able to decide on their own research agenda, hiring and firing personnel, teaching and long-term objectives. CONEAU (see above) is responsible for assessing the programmes. In budgetary terms, the bulk of funding is allocated via a formula that takes into account the size and characteristics of the institution. Particular contract-schemes such as the Research Incentive Plan rewards performing research activities, but they do not affect the direction of research as such.

In relation to the management and recruitment of their own authorities, most of the public institutions require the person to be either an active or former professor.

3.3.3 Academic funding

The allocation of public funds to the public universities is on the form of block funding and is based on a methodology agreed by the CIN which takes into account objective information for each university as number of enrolled students (newly enrolled and re-enrolled sorted by number of subjects passed the previous year), rate of re-enrolment, location and length of courses, distribution of the faculty by dedication and number of personnel as part of the wage incentive programme and the covered square meters. A significant proportion of the money allocated to PRO institutions (such as CONICET, INTA, INTI, CONAE y CNEA) and the public universities is related to the wage bill of their tenured staff.

3.4 KNOWLEDGE TRANSFER

3.4.1 Intellectual Property (IP) Policies

In the recent decade, public universities have advanced in the formulation of procedures and protocols concerning technology transfer, intellectual property rights and technical assistance to the private sector. However, while almost 70% of the public HEI have specific approved norms for these matters, only half present specific previsions and regulations concerning intellectual property matters (RedVitec, 2006). Out of the 21 universities that tackle IPR matters in their regulations, 16 address matters of confidentiality, 11 refer to the patentability of results, and 9 regulate the distribution of benefits.

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its careers before CONEAU. Although some faculties of the University of Buenos Aires regularly reject the actions of the Commission, others have voluntarily initiated the process of self-assessment and accreditation.

3.4.2 Other policy measures aiming to promote public-private knowledge transfer

Spinoffs

FONARSEC via Technology-Based Companies (*EMPRETECNO - TBC*) aims at promoting the development of technology-based companies in different productive areas. In a complementary line, and attempting to address the lack of funding for technology based start-ups, MINCYT created in December 2010 a programme called *PROFIET* (Programme of Support to the Entrepreneurial Investment in Technology) to encourage entrepreneurial investment in technology. The programme aims to attract investors and venture capital operators. Operators, meanwhile, will coordinate the implementation of the programme, administering the trust. The programme depends on the Administrative Coordination Secretariat of the MINCYT and is regulated by *Ministerial Resolution 69/2010.* Venture capital in the country had many false starts under different programmes. Research on the status of the venture capital market in Argentina showed that although approximately €50m were available for investment in 2008, less than 10% of this amount was invested. Although European funds and funds belonging to Multilateral Agencies (mainly the Inter-American Development Bank) are available, venture capital funds were mobilised mostly from national sources

Inter-sectoral mobility

There is no quantitative data available on the inter-sectoral mobility of researchers but the overall impression is that it is very limited. CONICET, PROs and, to a lesser extent, public universities offer tenured positions providing weak incentives to switch to the business sector. University professors have a right within some limitations to work in parallel for consultancies and research projects for the private sector organisations and enterprises. This actually may give a possibility to identify some needs of the industry and better align the research and educational work of the university with the specific needs of the business sector and the economy in general. However, an important share of the exchanges and activities performed by researchers for private sector entities aim at performing trials and quality certifications rather than joint research efforts.

Promoting research institutions - SME interactions

Linkages between research and academic institutions and the business sector are limited in the country. In fact, the business funding of R&D at HEIs only accounted for a negligible figure of 0.55% in 2012, dropping from 0.63% in 2009. The government has recognised the problem and has introduced policy instruments aimed at promoting the formation of linkages and university-industry cooperation in two complementary dimensions: (a) the upgrading of the capabilities of individuals and institutions serving as knowledge brokers and (b) via the promotion of clusters. In relation to the first dimension, ANPCYT has set up a programme aimed at supporting the training of managers and technological linkers.

Secondly, *PI-TEC* (Integrated Projects for Productive Conglomerates) finances - through competitive public processes- projects to encourage the development of clusters, by promoting alliance-building and collaborative work among enterprises and universities, provincial or local governments, and/or research centres. Given its integrating nature, PI-TEC seeks to improve coordination and synergies among the instruments available at FONCYT and FONTAR. PI-TEC requires the participation of representatives of at least three key participants in the development of the productive

cluster, such as representative business entities, technological entities, universities, provincial or municipal governments, or other organizations relevant to the productive cluster. The new strategic plan puts further emphasis on the need to articulate further the STI system and propose network innovation and justifies the so-called Strategic Socio-Productive Nuclei (SSPN) (*Núcleos Socio-Productivos Estratégicos*).

Involvement of private sector in the governance bodies of HEIs and PROs

As such, private firms or their representatives do not tend to be actively involved in the direction of public universities or PRO. Similarly, the business is almost absent from funding R&D at HEIs (0.55% in 2012).

Regional Development policy

Constituted as a federal country (a federation of 23 provinces and an autonomous city), the powers of the State in science and technology are located at federal and provincial levels. While the system is dominated by public funding, the federal government concentrates the main national policy-making bodies, direction and coordination, including the Ministry of Science, Technology and Productive Innovation (MINCYT). In the National Congress, the House of Senate and the House of Representatives have committees on science and technology whose function is to provide a detailed analysis and suggestions on legislative measures that concern R&D and innovation. At the provincial level, although all governments have the same powers, only some governments have their own agencies for the promotion and coordination of scientific and technological activities. The most relevant examples are the Ministry of Science and Technology of the Province of Cordoba and the Scientific Research Commission of the province of Buenos Aires (CIC). The existing provincial agencies (mostly to be found in the most developed provinces) contribute with small funding. In practice, both the policy design and the promotion responsibilities are mostly addressed by the federal government.

The Federal Council of Science, Technology and Innovation (COFECYT), created by the *Law 25.467/2001* acts as an advisory board in matters related with the articulation between national and regional (sub-national) policies and priorities. The members of this council are the highest authority in the science, technology and innovation from each of the provinces and the Autonomous City of Buenos Aires.

The Federalization of the National Programme of Science, Technology and Innovation programme (PROFECYT) was created in 2004 under COFECYT to promote and safeguard the development and activities aimed at strengthening science, technology, innovation and knowledge transfer to society in all provinces and regions of the country. With a budget of €19.4m in 2011 for a total of 910 projects (almost tripled the slightly below €7m of 2010) PROFECYT aims specifically at reducing the technology gap between different provinces. Every year COFECYT provides grants focused on the local needs of provincial government agencies, industry and civil society. To ensure a fair and balanced funding, COFECYT allocates equal amounts of funding across the different provinces. The different programmes include: Tourism Sector Technology Support (ASETUR, created in 2008); Municipal Technological Development Projects (DETEM); Federal Productive Innovation Project (PFIP) and Federal Productive Innovation Project - Productive Linkages (PFIP - ESPRO).

3.5 ASSESSMENT

Argentina has heavily invested in increasing the number of researchers. Pushed by budgetary expansions, we observe an expansion of researchers at PRO and universities together with a constant rise in wages. However, there are still weak incentives to increase the number of researchers within the business sector or to foster the mobility of researchers across sectors. At the same time, firms or their representatives do not tend to be actively involved in the direction of public universities or PRO. Similarly, the business is almost absent from funding R&D at HEIs.

Programmes aimed at increasing coordination and collaborative research with the business sector hasn't yet proved to be effective at a sufficient scale. The new strategic plan puts further emphasis on the need to articulate further the STI system, proposes network innovation and justifies the so-called Strategic Socio-Productive Nuclei (SSPN) (Núcleos Socio-Productivos Estratégicos).

Although the country exhibits a great heterogeneity within its regions, the instruments aimed at improving the research performance of the lagged regions seem to come short in relation to the challenge faced by the system.

4 International R&D&I Cooperation

4.1 MAIN FEATURES OF INTERNATIONAL COOPERATION POLICY

International co-operation in S&T is conceived as a fundamental component to achieve the objectives pursed by MINCYT. Argentina has a long tradition of international cooperation, evident in the important number of cooperation agreements subscribed so far. New research calls, specifically in the areas of societal and global challenges, increasingly require forming an international consortium to benefit from joint funding by the countries involved. Although, less institutionalized and powerful than the process of European integration, recent initiatives by MERCOSUR, including movements towards a MERCOSUR research area and a common framework programme, are oriented towards the identification of topics for joint research and exchange among the member countries.

4.2 NATIONAL PARTICIPATION IN INTERGOVERNMENTAL ORGANISATIONS AND SCHEMES

In relation to the realization of joint research projects and training, exchange of experts, and transfer of results to the national productive sector, the most important initiatives in inter-governmental research initiatives include:

1. *BIOTECSUR* is a biotechnology platform for the MERCOSUR countries originating in the BIOTECH - MERCOSUR – EU project for the development of specific R&D actions focused on regional priorities.
2. Argentinean-Brazilian Biotechnology Centre (Centro Argentino Brasilero de Biotecnología - *CABBIO*): A coordinating entity that includes a network or biotechnology research groups. Its objective is to promote interaction between science centres and the productive sector by means of two types of activities: The implementation of bi-national projects for research and the development and training of high-level human resources with courses at the Argentinean/Brazilian School of Biotechnology (Escuela Argentina Brasileña de Biotecnología - EABBIO).
3. Argentine-Brazilian Centre of Nanoscience and Nanotechnology (*CABNN*): Coordination body in which members of research groups, networks of nanoscience and nanotechnology, and companies from Argentina and Brazil support scientific and technological research in the area, and develop human resources and scientists from both countries. Their actions include: human resources training, exchanges of teachers and researchers, coordination of national networks of Nanoscience and Nanotechnology, establishment of joint working groups including companies to identify market niches, products and developments.
4. Italian-Argentinean Satellites System for Emergency Management: This is a joint initiative of Argentinean and Italian space agencies to prevent, mitigate and assess catastrophes, to preserve the environment and to improve agriculture. This is the first satellite system in the world designed specifically for this purpose.

At the same time, Argentina participates in several networks of exchange of information and practices. The most important include:

1. Ibero-American Network for Local Knowledge and Practice on the Plant Environment (RISAPRET) within the framework of the *CYTED* Ibero-American Programme for Science, Technology and Development
2. Multinational System of Specialised Information on Biotechnology and Food Technology for Latin America and the Caribbean (SIMBIOSIS): A virtual network for connecting scientists, experts and research centres interested in biotechnology, food technology and biodiversity.

4.3 COOPERATION WITH THE EU

4.3.1 Participation in EU Framework Programmes

Research cooperation between the EU and Argentina dates back to the 3rd Research Framework Programme (1990-1994). In 1999 both parties signed a Science and Technology Cooperation Agreement in order to strengthen cooperation and extend it in areas of mutual interest. This agreement proposes facilitating Argentina's interaction with the European Research Area. Argentina also has bilateral S&T agreements with several EU Member States involving joint research, institutional cooperation, students and researcher's mobility, and initiatives for sharing the use of research infrastructures.

The seventh Steering Committee for the EU-Argentina Science and Technology Agreement met in Brussels on the 18th of April 2013. In July 2010, in occasion of fifth meeting, the Steering Committee produced a roadmap for the period 2010/2011 for the Scientific and Technological Cooperation between the EC and Argentina. Results on the country's participation in Framework Programmes confirm the encouraging upward trend since FP5. In addition, Argentina is also an active participant in several European regional external relations cooperation programmes focused on education, science, technology and/or innovation. Among these are ALFA, ALBAN and @lis.

Since 2005, when Argentina signed the S&T cooperation agreement with the EU, the European Union Liaison Bureau has assisted the Argentinean scientific community and has provided it with information regarding possibilities for cooperation through the EU Framework Programmes.

Concerning the country's participation on international projects, one can note a positive development in terms of the country's participation in the EU Framework Programme for RTD since the 5th Framework Programme. In FP5 participation amounted to 29 contracts, in FP6 (2002-2006) 95 participations happened in 78 projects.[22] For the current FP7 (2007-2013), a total of 826 teams have applied as part of 653 projects in 17 different programmes. Argentina managed to have 156 shortlisted proposals, in which 200 research teams participates (achieving a success rate of 24,2%) with a total project investment of almost €369m. The most important type, with more than a third of the shortlisted projects, refers to those aimed at

[22] The total investment in these projects with Argentinean participation was €317m for an EC contribution of almost €218m. The investment of Argentinean teams was about €9.2m attracting an EC contribution of almost €7.6m.

supporting the Marie Curie International Research Staff Exchange Scheme (IRSES). The tables below present this information.

		All submitted		Mainlisted			Success Rate: applicants in mainlisted proposal / applicants in all submitted proposals - applicants from Argentina
Proposal SP Description2	Proposal Program	Number of Proposals	Number of Applicants	Number of Proposals	Number of Applicants	Proposal Total Cost	
SP1-Cooperation	ENERGY	20	34	2	4	6,150,595	11.76%
SP1-Cooperation	ENV	90	136	11	17	58,424,373	12.50%
SP1-Cooperation	HEALTH	57	69	13	16	59,743,996	23.19%
SP1-Cooperation	ICT	63	71	11	13	81,093,580	18.31%
SP1-Cooperation	KBBE	80	99	21	22	78,659,322	22.22%
SP1-Cooperation	NMP	23	29	7	10	25,653,138	34.48%
SP1-Cooperation	SEC	1	2				
SP1-Cooperation	SPA	9	11				
SP1-Cooperation	SSH	63	74	6	7	20,198,447	9.46%
SP1-Cooperation	TPT	17	23	3	6	2,043,453	26.09%
SP2-Ideas	ERC	8	10				
SP3-People	PEOPLE	187	224	67	90	1,149,144	40.18%
SP4-Capacities	INCO	14	19	7	7	13,543,887	36.84%
SP4-Capacities	INFRA	9	11	4	4	16,692,132	36.36%
SP4-Capacities	REGIONS	1	2				
SP4-Capacities	SiS	9	9	4	4	5,073,740	44.44%
SP4-Capacities	SME	2	3				
	Sum:	**653**	**826**	**156**	**200**	**368,425,807**	**24.21%**

Proposal Sub Funding Description	Number of Proposals	Number of Proposals
Collaborative project for specific cooperation actions dedicated to international cooperation partner countries (SICA)	144	19
Collaborative project (generic)	20	4
Collaborative Project targeted to a special group (such as SMEs)	15	4
Combined Collaborative Project and Coordination and Support Action	1	1
Coordinating action	45	14
Initial Training Networks (ITN)	14	2
Integrating Activities / e-Infrastructures	7	3
International Incoming Fellowships (IIF)	61	8
International Outgoing Fellowships (IOF)	14	2
International Research Staff Exchange Scheme (IRSES)	97	54
Large-scale integrating project	36	6
Research for Civil Society Organisations (CSOs)	7	2
Small or medium-scale focused research project	81	12
Small or medium-scale focused research project INFSO (STREP)	16	1
Supporting action	77	24
	18	
Sum:	**653**	**156**

4.3.2 Bi- and multilateral agreements with EU countries

Argentina has signed STI agreements with over 150 countries and stands out for the number of ongoing projects and cooperation programmes with Brazil, Chile, Mexico, the U.S. and Canada in America; France, Belgium, England, Germany, the Netherlands and Italy in Europe; Israel, China and Japan in Asia, as well as South Africa in Africa. *FONCYT* has recently implemented calls for joint research projects with Israel, South Africa and Brazil. Outside the MERCOSUR region, the European Union and its Member States are perceived as the most important cooperation partners. This was demonstrated already in 1999, when Argentina was the first Latin American country to sign a cooperation agreement with the EU.

4.4 COOPERATION WITH NON EU COUNTRIES OR REGIONS

4.4.1 Main Countries

Argentina's main partner outside the EU is Brazil. This has manifested in several initiatives related with joint research calls (such as for the production of vaccines or stem cells) and the establishment of joint training and research initiatives in biotechnology (CABBIO) and nanotechnology (CANN).

Also, as a member of the Common Market of the South (MERCOSUR) and is a participant in the *Science and Technology Framework Program of Mercosur* 2006-2010 established under the Specialized Meeting on Science and Technology of MERCOSUR (*RECYT*). The presidents of the member states suggested the creation of the RECYT during the second meeting of the Common Market Council (CMC) in

1992. RECYT aims at the promotion of scientific and technological development of Member Countries of MERCOSUR enabling them to modernise their economies, expanding the range and quality of goods and services produced. Its actions are structured in terms of increasing the productivity of the economies of MERCOSUR and increase the competitiveness of productive sectors of the MERCOSUR in third markets.

RECYT participates in negotiations, including those between MERCOSUR and the European Union on science and technology issues. At the Latin-American regional level, one of the main fields of activity of the RECYT is the promotion and encouragement of research at all levels, aiming to find solutions to problems common to countries of the region and contributing to the process of regional integration. The most important initiatives of RECYT include the yearly S&T Award MERCORSUR, the *BIOTEC SUR platform*, *Digital Mercosur* and the MERCOSUR Framework Programme 2006-2010. The MERCOSUR Framework Programme 2006-2010 is conceived as an instrument to achieve the MERCOSUR Science, Technology and Innovation Area, encouraging the consolidation of scientific and technological development of countries of the region. In order to have a permanent funding mechanism that will be able to ensure the allocation of resources on a stable and continuous basis, member countries and MERCOSUR partners make efforts to identify multiple sources of promotion, and also evaluate the use of Structural Funds.

4.4.2 Main instruments

MINCYT's National Directorate of International Relations is in charge of dealing with matters related with cooperation with foreign countries, agencies and other institutions of international character, linked to science, technology and innovation. It directs its actions to strengthen, complement and integrate the capabilities of local research and development abroad. In that sense, it promotes the realisation of joint research projects and training, exchange of experts, and transfer of results to the national productive sector.

4.5 OPENING UP OF NATIONAL R&D PROGRAMMES

National programmes are not currently open for third country researchers. However, recent calls by *FONCYT* were aimed at funding joint research projects with Israel, South Africa and Brazil. Similarly, latest research calls in the areas of biotech and stem cells will fund the establishment of consortia between Brazilian and Argentinean research groups.

4.6 RESEARCHER MOBILITY

4.6.1 Mobility schemes for researchers from abroad

MERCOSUR has advanced on the integration of education systems specifically at the lower levels of education. Educational courses at the primary or junior high level, provided that they do not entail technical studies, are *recognized* by other member states as being on the same level for all member nations. Specifically, Argentine *legislation on higher education* states that the same rules and rights applicable to Argentine citizens shall be applicable to those that are foreigners. MERCOSUR, Bolivia and Chile have agreed in 2002 to confer Residency and the right to work for all its citizens with no other requirement than proof of nationality and a negative criminal record. This residency right is not fully matching the right of a free

movement of persons. Thus, researchers from the MERCOSUR and associated countries can move to Argentina.

In addition, ANPCYT has recently introduced a scheme of joint projects under the PICT umbrella. This scheme allows for short stay mobility of the researchers involved in the project.

4.6.2 Mobility schemes for national researches

The recently established *Bec.AR* scheme is expected to fund short-term stay of Argentinean researchers abroad. So far, there are no precisions concerning the conditions, duration or specific support for this programme. Through the ALBAN programme - an EU programme for high-level scholarships for Latin America - a total of 314 Argentineans have received scholarships (just under 10% of the total for all Latin America):[23] 127 were for Master students, 169 for PhD students and 18 for specialisations in the five calls opened between 2003 and 2008.

[23] Read more: *http://ec.europa.eu/europeaid/where/latin-america/regional-cooperation/alban/index_en.htm*

5 CONCLUSIONS

The government of Argentina has taken bold measures aiming at achieving a better performing research system capable of serving social needs and promote an upgrading in the specialisation pattern based on the application of nanotechnology, biotechnology and information and communication technologies (take *FONARSEC* as an example). At the same time it increased resources, expanded the research community and the associated infrastructure, it has established calls for joint research projects with other countries. However, it is still lagging behind in terms of excellence of its research infrastructures. At the same time, lack of appropriate evidence weakens the policy design and instrumentation.

Despite the efforts (such as the introduction of sectoral funds and specific sectoral priorities) and quantitative targets, the ability to mobilise monetary resources from the private sector is still very limited and is explained mainly by the size and composition of the productive sector. As such, the objectives related to the private sector are far from realized. It should be noted that the results and policies oriented to the increase of high-skilled S&E human resources, stimulated by the expansion of under- and post-graduate scholarships might contribute to stimulate demand for knowledge, but also to improve excellence in research. So far, however, it is possible to observe a drop in the efficiency of the system give the faster increase of monetary inputs than scientific and technological outputs.

The knowledge triangle is not fully operative in the case of Argentina. Although some coordination instances (such as GACTEC) have aimed at increasing the dialogue and cooperation between the different agencies, only limited success has been achieved. As a whole, the education and research parts are significantly better developed and achieve more progress than innovation. In this sense, policy practice in the form of separate ministries has created own objectives and ways of intervention on the different components of the triangle. Although the practice of competitive and performance-based funding is becoming the standard intervention in the promotion of R&D and innovation (via MINCYT and ANPCYT), block funding for R&D devoted centres and research and education institutions still dominates as the allocation mechanism. Hence, in parallel to the increasing budgets and efforts of research and education, more emphasis is needed to create bridges and reinforce the triangle (particularly via competitive incentives). Knowledge demand remains the weak factor, despite significant and generous incentives. Policy is emphasising this priority yet without any visible change in terms of outcomes and impacts.

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7 LIST OF ABBREVIATIONS AND RELEVANT INSTITUTIONS

ASETUR (Tourism Sector Technology Support): Programa de Apoyo al Sector Turismo.
ANPCYT (National Agency of Promotion of Science and Technology): Agencia Nacional de Promoción Científica y Tecnológica.
CICYT (Inter-institutional Council for Science and Technology): Consejo Interinstitucional de Ciencia y Tecnología.
CIC (Scientific Research Commission, province of Buenos Aires): Comisión de Investigaciones Cientificas, Provincia de Buenos Aires.
CIN (National Inter-university Council): Consejo Interuniversitario Nacional.
CITEFA (Institute of Technical and Scientific Research for Defence): Instituto de Investigaciones Científicas y Técnicas para la Defensa.
CNEA (National Atomic Energy Commission): Comisión Nacional de Energía Atómica.
COFECYT (Federal Council on Science and Technology): Consejo Federal de Ciencia y Tecnología.
CONAE (National Commission of Space Activities): Comisión Nacional de Actividades Espaciales.
CONEAU (National Commission for University Evaluation and Accreditation): Comision Nacional de Evaluación y Acreditación Universitaria.
CONICET (The National Council for Scientific and Technical Research): Consejo Nacional de Investigaciones Científicas y Técnicas.
CRUP (Council of Rectors of Private Universities): Consejo de Rectores de Universidades Privadas.
FONARSEC (Argentine Sectoral Fund): Fondo Argentino Sectorial.
FONCYT (National Science and Technology Fund): Fondo para la Investigación Científica y Tecnológica.
FONSOFT (Fiduciary Fund for the Promotion of Software Industry): Fondo Fiduciario para la Promoción de la Industria del Software.
FONTAR (Argentine Technological Fund): Fondo Tecnológico Argentino.
GACTEC (Scientific and Technological Cabinet): Gabinete Científico y Tecnológico.
GTec (Training Programme for Managers and Technological Linkers): Programa de Formación de Gerentes y Vinculadores Tecnológicos.
INTA (National Institute for Agricultural Technology): Instituto Nacional de Tecnología Agropecuaria.
INTI (National Institute of Industrial Technology): Instituto Nacional de Tecnología Industrial.
IDB: Inter-American Development Bank.
MERCOSUR (Common Market of the South): Mercado Común del Sur.
MINCYT (Ministry of Science, Technology, and Productive Innovation): Ministerio de Ciencia, Tecnología e Innovación Productiva.
PEI (Institutional Assessment Programme): Programa de Evaluación Institucional.
PFI (Federal Infrastructure Plan for Science and Technology), Plan Federal de Infraestructura para la Ciencia y la Tecnología 2008-2011.
PFIP (Federal Productive Innovation Project): Proyectos Federales de Innovación Productiva.
PI-TEC (Integrated Projects for Productive Conglomerates): Proyectos Integrados de Aglomerados Productivos.

PPL (Technology Platforms Projects): Proyectos de Plataformas Tecnológicas.
PRIETec (Technological Infrastructure and Equipment Projects): Proyectos de Infraestructura y Equipamiento Tecnológico
PROBITEC (Bi-national Program on Cellular Therapy): Programa Binacional de Terapia Celular.
PROFECYT (Federalization of the National Program of Science, Technology and Innovation): Programa Nacional de Federalización de la Ciencia, la Tecnología y la Innovación.
PROFIET (Program of Support the Entrepreneurial Investment in Technology): Programa de Fomento de Innovacion Emprendedora en Tecnología.
SECTel (State Secretary for Science, Technology and Innovation, province of Santa Fe): Secretaria de Estado para la Ciencia, Tecnología e Innovación.
WB: World Bank.