

***D.5.4 – Status of ICT Policy Development –
Country Report Uruguay***

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1 INTRODUCTION

This report presents the Status of ICT Policy Development in Uruguay, and summarizes the situation of ICT in the country, including the status of public policies for industry development, as well as the strategies at corporate and business association level. The report is part of the deliverables included in WP5 (D5.1 – D5.4), which are to provide an overview and common understanding on ICT policies in the Latin American PRO-IDEAL countries, in view to possible future EU-LA cooperation.

The objectives of WP5 are to strengthen ICT dialogue with selected stakeholders from the EU and PRO-IDEAL target countries, i.e. Argentina, Brazil, Chile and Uruguay, in order to support Latin American national policies on international S&T co-operation in the ICT field, as well as to involve other stakeholders or initiatives in the PRO-IDEAL activities. The reports included in WP5 intend to contribute to the dialogue and cooperation in ICT R&D between the European Union and Latin America through the dissemination of the national policies and priorities in that area. A common methodology and structure for all the reports was agreed, in order to facilitate comparisons and extract common conclusions.

In order to produce this paper, interviews with the main stakeholders in ICT, including representatives from the national agencies, the universities and the private sector, were conducted. In addition, a review of the national policies, legal framework and strategies at private, public and academic sectors for ICT development was performed.

The reports are based also in previous research and surveys conducted by PRO-IDEAL: the report on ICT priorities in Latin America (D.1.2), published in may 2009, and the survey performed in June 2010 by PRO-IDEAL and PRO-IDEAL Plus on ICT research priorities in the countries partnering in the PRO-IDEAL projects.

In addition, the report includes the results of an original survey carried out by LATU during the second half of 2010, which comprises a revision of public policies and strategies for ICT development in Uruguay and a survey on the groups working in ICT R&D in the country.

Both the results of the PRO-IDEAL survey on ICT research priorities in Latin America and the preliminary results of the LATU survey on ICT development in Uruguay were presented during the Workshop on Public Policies and Research in ICT that took place in Montevideo, Uruguay in August 30th 2010, organized by LATU and the PRO-IDEAL consortium.

Chapter 2 describes the national policies and strategies aimed at developing ICT. In the first part of this chapter, public policies and strategies are reviewed, including policies for ICT in education. In the second part, policies promoting cross-sectional incorporation of these technologies in other value chains are described. The third part describes the main aspects of the strategies set by the private sector to promote industry growth. Finally, the legal framework and other public documents relevant to national ICT policies are referred. Chapter 3 covers the main stakeholders in ICT, including public organizations, academic institutions and private companies and organizations. Chapter 4 discusses the national policies specifically aimed at ICT research & development. To conclude, Chapter 5 describes ICT priorities for research and development, including priorities at a national level and regarding cooperation with the European Union. The survey main results of the ICT R&D groups in the country, including their fields of activity and relations with European and other international research groups, is presented.

2 NATIONAL POLICIES AND STRATEGIES FOR ICT INDUSTRY DEVELOPMENT

2.1 Public Policies and Strategies for ICT Development

The development of the ICT companies in Uruguay started in the late 80's and it continued to thrive in the 90's, even in the absence of any specific promotion policies. A fiscal waiver policy subsequently implemented spared the development of software of any corporate income tax. This policy was revised in 2009, stating the phase out of tax exemptions for domestic market sales. As of 2011, only the foreign market development activities remain income-tax free.

In addition to this specific policy, the companies devoted to ICT are ruled by the general promotion framework, i.e., the Investment Law that specifically supports innovation aspects and the creation of highly qualified jobs; it allows for direct subsidies to entrepreneurial or research projects managed by the National Agency for Research and Innovation (ANII). Furthermore, there are subsidies in the training of human resources not particularly oriented to ICT but including the sector.

The Investment Law is based on the fiscal waiver applied to direct investment. This has a very relative impact on the ICT sector, since these types of companies do not require large capital investment. The law also foresees potential income tax exemptions. The firms in this sector have not profited significantly of the benefits foreseen in the Investment Law.

The ANNI programs that aim at the entrepreneurial sector seek to promote innovation without any specific bias. They usually consist of subsidies covering up to 50% of the project; with a maximum of USD 250,000 (only exceptionally may that subsidy reach USD 400,000). The software companies are regular users of these benefits, and they clearly account for most of the applications.

2.1.1 ICT and Education

Uruguay has strongly pushed for policies oriented to provide universal access to the Internet, as a relevant issue. The Ceibal Plan has been defined as a program with three key pillars: Education, Technology and Equality. The two latter are directly linked to the access policies. To date, the Ceibal Plan has already given evidence of a significant impact, and it is estimated that that impact will continue to grow in the short and medium term. It has involved delivering 360,000 laptops to schoolchildren, as well as making Internet connection available at all public primary schools. This has meant a ground-breaking change for most low - and middle-income households, contributing to the reduction of the digital divide. It has also led to the development of several projects in the area of digital contents.

This aspect of the Ceibal Plan – its impact on the provision of access- will be strongly boosted in 2011: ANTEL, the state-owned telecommunications company, has announced a universal access plan whereby ADSL services will be provided to customers and will be included in their monthly telephone bill with no additional charges. These programs combined will probably have an important stimulating effect on the Internet services.

2.1.2 Initiatives promoting entrepreneurship and public/private partnerships

The country has consolidated a system to promote entrepreneurship and new startups in recent years. One of the pioneer initiatives, in the early 2000's, was the creation of an ICT business incubator- Ingenio – which in the latest years has been accompanied by other institutions and instruments: ANII offers subsidy instruments for new innovative companies; the Emprender Fund (public-private initiative supported by IADB's Multilateral Investment Fund) grants seed capital of up to USD 50,000; the National Bank (Banco de la República) offers a special line of credit to the companies gathered in CUTI, and Endeavor, a private entrepreneurship development program, adds to network support and business advice complementary to the incubator services. In addition, there is a network of angel investors and a venture capital investment fund. Likewise, it is important to underscore that the Universities support the creation of new companies through pre-incubators, including ORT's Center for Innovation and Entrepreneurship, the Catholic University's Nexo and UdelaR's Ricaldoni Foundation.

The entrepreneurial support ecosystem is not limited to ICT companies; however, as ICT is one of the most dynamic branches of the Uruguayan economy, most of the projects leveraged by this system belong to this sector.

2.2 Active public policies for ICT industry development as cross technology in other value chains

In this field, there are initiatives pushed by ANII and the National Institute of Agricultural Research (INIA). INIA has historically managed programs for the promotion of investment and research in the agricultural sector as part of its mandate.

In 2009 INIA, ANII and the Ministry of Livestock, Agriculture and Fishery (MGAP) launched a specific fund called INNOVAGRO, aimed at incorporating technology into the agro-industrial chains. ICT and biotechnology are examples of the technologies especially promoted through that fund. The results of the first year of operations of the Fund have not met the expectations in the field of ICT, mainly owing to the small number of applications for important projects. The Ministry of Industry (MIEM) is developing 'cross-sectional' initiatives that have failed to show much impact so far.

Likewise, ANII funded the creation of the Master's Degree on BioInformatics, (UdelaR, the Clemente Estable Research Institute and the Montevideo Pasteur Institute) and the creation of the ORT University's Master's Degree on Technological Business Management. Furthermore, ANII contributes to the funding of Ingenio Business Incubator.

2.3 Strategies at corporate or business associations level for ICT industry development

The Chamber of ICT industry (CUTI) has made key efforts to define a strategy for the sector. Some definitions are worth being quoted verbatim:

"Outputs: The objective is to achieve the growth of companies, or to improve their exports status and to attain a greater employment rate. Market: We aim at positioning Uruguay as a dependable knowledge-driven country, possessing a globalized, reliable, safe and qualified industry. Processes and activities: We are

focusing on initiatives that increase the exports capacity, improve productivity and business management by promoting the capital market, improve the local environment by promoting innovation and encourage social corporate responsibility in the sector. We especially promote partnerships at a corporate level, so the players can make the most of synergies and overcome scale limitations. Moreover, we especially emphasize innovation, not only from the technological point of view, but also through promoting new business models, enabling companies to achieve sustainable competitive advantages. The cloud computing strategies are an example (SaaS, Web 2.0, etc.). Development Bases: The key elements needed to meet these objectives are: to develop business leadership, to enjoy a stable and transparent institutional and regulatory environment, with strong educational and infrastructure bases, guaranteeing the availability of resources.”

The aspects below are to be highlighted:

Exports Vocation

The local market being very small, many companies devote great efforts to develop the regional and global markets. CUTI is making specific efforts in that direction, and there are also public initiatives pushed regularly to support this policy (in addition to tax exemption policies)

Improving productivity

This industry has an annual per capita turnover of about USD 50,000, the yield obtained by companies in India, but far from the performance of USA companies. Some companies have invested and continue to invest in programs to improve processes in general, seeking certifications such as CMMI or ISO 9000.

Recruitment

The sector is enjoying full employment, and CUTI is implementing programs to promote ICT training to high school graduates. The program ‘Hacé Click’ aims at directing young people to ICT-related jobs.

Improving management skills

This aspect is also visualized as an improvement opportunity for ICT companies, and as such, it is promoted by the chamber and other programs.

Associativity

The size of Uruguay is also mirrored in the size of its companies, who find it hard to reach a critical size that may enable them to operate successfully and profitably in larger (regional and global) markets. Supporting corporate partnerships, especially stressing joint-ventures oriented to exports markets, are also part of the business policies implemented in this sector.

Technologies

The ‘software as a service’ technologies, and in general the “delocalized” technologies, such as ‘cloud computing’ and ‘Internet 2.0’ are perceived as the technological direction that may enable this industry to develop a new phase characterized by a significant expansion.

Internationalization is seen as the way to go by the business sector. It is important to highlight that neither the ‘cross sectional’ application of ICT to other sectors of economy, or improving the relations with the academia and the research sectors, are considered priorities, revealing important differences both with the public sector and the academia.

2.4 Legal framework and other public documents relevant to national ICT policies

2.4.1 R&D

The National Strategic Plan for Science, Technology and Innovation (PENCTI)¹, approved by the Government in February 2010, includes ICT among its strategic and priority areas. In keeping with that, both the Investment Law and the subsidies managed by ANII include ICT projects or ICT-intensive projects. To establish the actual priorities for ICT R&D, this report reviewed the groups actually working in ICT research in the country.

2.4.2 Private Sector

There are number of legal instruments to promote ICT commercial activities, among other innovative actions in the country. One of the main ones is the Investment Law (Law 17.555)², that establishes tax exemptions and other investment benefits for ICT companies.

2.4.3 e-Government

The Agency for the Development of Electronic Government and Knowledge and Information Society (AGESIC), created by law in December 2005, aims at improving government services to the citizens, using the benefits of ICT.

Among other responsibilities, AGESIC is in charge of the Digital Agenda³, Information Security (including the National Response Center for Information Security Issues (CERTUy)⁴, the Protection of Personal Data (Law 18,331)⁵, Access to Public Information (Law 18,381)⁶, and Electronic Signature (Law 18,600)⁷.

2.4.4 Education

The Uruguayan Government launched in 2006 Plan Ceibal, an ambitious plan to shorten the digital divide, providing every schoolchild in the public education system with a laptop connected to the Internet. An organization was created by law⁸, which is in charge of managing the plan.

¹ http://www.anii.org.uy/web/static/pdf/PENCTI_Decreto.pdf

² <http://www.parlamento.gub.uy/leyes/AccesoTextoLey.asp?Ley=17555&Anchor=>

³ http://www.agesic.gub.uy/innovaportal/file/447/1/agenda_digital2008-2010.pdf

⁴

http://www.agesic.gub.uy/innovaportal/v/290/1/agesic/articulo_73_de_la_ley_n%C2%B0_18362_de_06_de_octubre_de_2008.html?menuderecho=1

⁵

http://www.agesic.gub.uy/innovaportal/v/302/1/agesic/ley_n%C2%B0_18331_de_11_de_agosto_de_2008.html?menuderecho=1

⁶

http://www.agesic.gub.uy/innovaportal/v/310/1/agesic/ley_n%C2%B0_18381_de_17_de_octubre_de_2008.html?menuderecho=1

⁷

http://www.agesic.gub.uy/innovaportal/v/311/1/agesic/ley_n%C2%B0_18600_de_21_de_setiembre_de_2009.html?menuderecho=1

⁸ <http://www.parlamento.gub.uy/leyes/AccesoTextoLey.asp?Ley=18719&Anchor=>

3 PUBLIC & PRIVATE INSTITUTIONAL STRUCTURE FOR DEVELOPMENT OF ICT

3.1 Public and research institutions

Below is a list of the three main agencies of the many that implement programs for the promotion of ICT in Uruguay:

- **AGESIC** (E-Government and Information Society Agency⁹)
This agency is in charge of defining the ICT standards, providing advice to state bodies. In general terms, the agency is responsible for supporting and implementing the e-government initiatives. It is the body in charge of the Digital Agenda and monitoring the UN's Millennium Development Goals.
- **ANII** (National Research and Innovation Agency¹⁰)
In charge of developing programs to promote research and innovation activities; the agency administrates various grants for basic and applied research projects; it provides funds to support business projects (open to all activity sectors). It offers a specific fund for the projects destined to agro industrial chains that enhance the incorporation of technology in this sector.
- **Plan Ceibal** (Center for Social and Technological Inclusion¹¹)
This agency is in charge of the 'One-laptop-per-child' Program in Uruguay, a program that is expected to have a very significant impact in the medium term. Not only does it is about providing every schoolchild with a laptop of his or her own and Internet connectivity at school and public places, but it also involves the local development of digital education contents by the Ceibal staff, all of which implies important changes in the country's education schemes. The program is now being expanded to high school students.

Other actors that play a significant role in the promotion of ICT are the Ministry of Economy (who sets the taxation policies and investment promotion schemes); and ANTEL, the state-owned telecommunications company that holds the monopoly of ADSL services.

3.2 Universities

The academic sector is concentrated in the schools of engineering of the three universities: the University of the Republic (UDELAR), with its Computing Institute and Electrical Engineering Institute, ORT University and the Catholic University (UCUDAL). From the point of view of student admission and enrollment, UDELAR concentrates almost three quarters of the total admission and 80% of the total enrollment in ICT careers.

These three schools have several research groups, which were included in the survey on ICT R&D groups and are listed in Chapter 5.

⁹ www.agesic.gub.uy

¹⁰ www.anii.org.uy

¹¹ www.ceibal.org.uy

3.3 Main private and corporate ICT stakeholders

3.3.1 The ICT industry

The companies are gathered in the Uruguayan Information Technologies Chamber, (CUTI)¹².

The industry employs over 10,000 people. The 2009 overall revenues were estimated as USD 560 million, 37.5% of which corresponded to exports.

Exceptional cases aside, the Uruguayan companies present one of the business models below:

- **Products or solutions:** The software produced is applied to a 'vertical market'. Some typical examples of this kind include banking systems, logistics, or integrated management systems (ERP). The customers requiring these products often request the development of specialized modules for some processes (typically in the finance sector); these cases usually require a significant consultancy component and specific developments.
- **Components and tools:** There are some companies that have developed tools and components to cater for the software market itself. In particular, the tool developed by 'Genexus'¹³ is very important and it has led to the development of a business community that uses this technology as the basis for their own development.
- **Consultancy Services and Implementation of Solutions:** The focus here is business consultancy and expert's consultancy on their own products or products developed by third parties. Several local companies have a strong regional presence in this market, having opened offices in multiple countries.
- **Software factory:** There are several firms that operate in the development of software under third party specifications, ranging from large multinational companies such as TCS, down to small enterprises that sell their services to other Uruguayan companies or directly to regional or global customers.

¹² <http://www.cuti.org.uy>

¹³ www.genexus.com

3.3.2 Companies and Organizations:

There are more than 300 ICT companies in Uruguay. Following is a list of some of the main ones (major multinational companies present in Uruguay are not mentioned):

- **Business Chamber of ICT Industries (CUTI – Cámara Uruguaya de Tecnologías de Información)**. This association, with more than 300 members, gathers the main private companies and organizations in the ICT industry (www.cuti.org.uy).
- **Software Testing Center (CES – Centro de Ensayos de Software)** is an organization specialized in providing testing services to the ICT industry (www.ces.com.uy).
- **Artech**. Leading provider of knowledge based software development tools. Based in Montevideo with offices in Brazil, Japan, Mexico and USA (www.genexus.com).
- **De Larrobla & Asociados**. Core Banking Solutions, clients in 14 countries in Latin America and USA (www.bantotal.com).
- **Infocorp**. Business Technology Consulting, software solutions (www.infocorp.com.uy).
- **GeoCom**. Global ICT solutions (points of sale, financial transaction switches, communications management systems. (www.geocom.com.uy).
- **CCC**. Development and manufacturing of complete real-time medical systems, including active implantable medical devices such as cardiac stimulators, programmer systems, battery chargers, patient wands and leads (www.ccc.com.uy).
- **Concepto**. Customs Management Solutions, ERP (www.concepto.com.uy)
- **Memory**. ERPs for small and medium sized companies (www.solucionesmemory.com).
- **ICA**. Specialized in GIS, tele-observation, GPS (www.ica.com.uy).
- **Ideasoft**. Business Intelligence, business planning and action, risk management solutions (www.ideasoft.biz).
- **Scanntech**. Retail business solutions, Points of Sale (www.scanntech.com.uy).
- **Top Systems**. Core banking solutions, global microlending solutions, anti money laundering solutions (www.topsystemscorp.com).
- **Buxis**. Human resources management solutions (www.buxis.com).
- **Arnaldo C. Castro**. Complete ICT solutions, business integrator, main hardware vendor (www.arnaldocastro.com.uy)
- **Conatel**. Complete ICT solutions, industrial and energy automatism, medical technology (www.conatel.com.uy).
- **Interfase** Telecommunications and ICT solutions (www.interfase.com.uy).
- **Quanam** Global ICT consulting services (www.quanam.com).
- **Sonda** ICT outsourcing, systems integration, infrastructure support, ICT consulting (www.sonda.com).

For a complete list of ICT companies in Uruguay, visit www.cuti.org.uy

4 NATIONAL POLICIES AND STRATEGIES FOR ICT RESEARCH & DEVELOPMENT

The definition of policies and strategies for ICT R&D at a national level is centered at the National Agency for Research and Innovation (ANII), created in 2005.

In the early stages of development of ANII, the National Strategic Plan for Science, Technology and Innovation (PENCTI)¹⁴ was developed and discussed, and it was finally approved by the Government in February 2010. PENCTI includes ICT among its strategic and priority areas. However, the national strategic definitions lack the depth needed to show directions or set priorities within the ICT research.

ANII has developed a number of programs to promote research and innovation. Those programs are not specific to ICT, but a substantial proportion of the projects applying to those programs belongs to ICT areas, or use extensively ICT.

The ANII programs targeting the private sector aim to innovation promotion generically. In general, they comprise subsidies up to 50% of the total project amount, with a USD 250,000 limit. ICT companies are heavy users of this program, and add up to a big percentage of the projects presented.

There are specific ANII programs that are research-oriented: the Clemente Estable Fund and the Maria Viñas Fund. The first one is aimed at basic research and the latter to applied research. Even though those funds are not specific to ICT, researchers in that area regularly apply to them.

The R&D activities in ICT at an academic level are concentrated in the schools of engineering of the main universities offering careers in ICT: UDELAR, ORT University and Catholic University (UCUDAL). The details of the review on ICT R&D groups in universities are presented in Section 5.

Regarding ICT in education, the Ceibal Plan, responsible for the development of the One-Laptop-per-Child program in Uruguay, promotes research in connectivity applied to the specific problems faced by OLPC projects, and in digital educational contents.

¹⁴ http://www.anii.org.uy/web/static/pdf/PENCTI_Decreto.pdf

5 ICT PRIORITIES FOR R&D

5.1 *Priorities at National Level*

Along with the creation of ANII, a National Researchers System (Sistema Nacional de Investigadores, SNI)¹⁵ was created, in which every researcher in the country in all fields of work are included. However, priorities for R&D are still not established as a national policy. Nevertheless, if we analyze the concrete actions of the various players, some priorities become apparent:

- **Production of digital educational contents, encompassing the audiovisual and education sectors:** These initiatives focus on the Ceibal Plan and Incubadora Ingenio. The Ceibal Plan acquires contents developed by local companies and conducts activities to promote joint projects among educators and software developers. Ingenio holds regular contests for audiovisual developments, and has incubated several companies in this sub-sector.
- **Developing the application of ICT to the agro-industrial chains:** ANII and INIA have made unsuccessful attempts to encourage companies to develop technology aimed at this sector. Although there are some projects underway – such as the electronic ear-tags system for cattle traceability– the initiative failed to elicit further efforts among entrepreneurs, who typically focus their efforts on exports.
- **Developments oriented to mobile applications:** In its new Genexus versions, Artech has guided its development efforts to mobile applications. Several new companies are also exploring this market using Apple and Android platforms.
- **R&D in logistics and transportation:** The logistics sector is growing very strongly in Uruguay. The software companies that offer products in this sub-sector conduct R&D projects in general, associated with the Computing Institute's Operational Research Department.

In conclusion, although there are no 'explicit priorities', there are public, private and public-private initiatives that seek to consolidate as permanent R&D lines. In order to identify those R&D lines, a survey to identify the groups working in ICT and their main lines of research was conducted by LATU in mid 2010. In addition, the PRO-IDEAL consortium performed a survey to identify ICT research priorities in target countries of Latin America¹⁶. The analysis was presented at the Workshop **on Public Policies and Research in ICT** that took place in Montevideo, Uruguay in August 30th 2010, organized by LATU and the PRO-IDEAL consortium.

¹⁵ <http://www.anii.org.uy/web/paginas/lista-de-integrantes-del-sni>

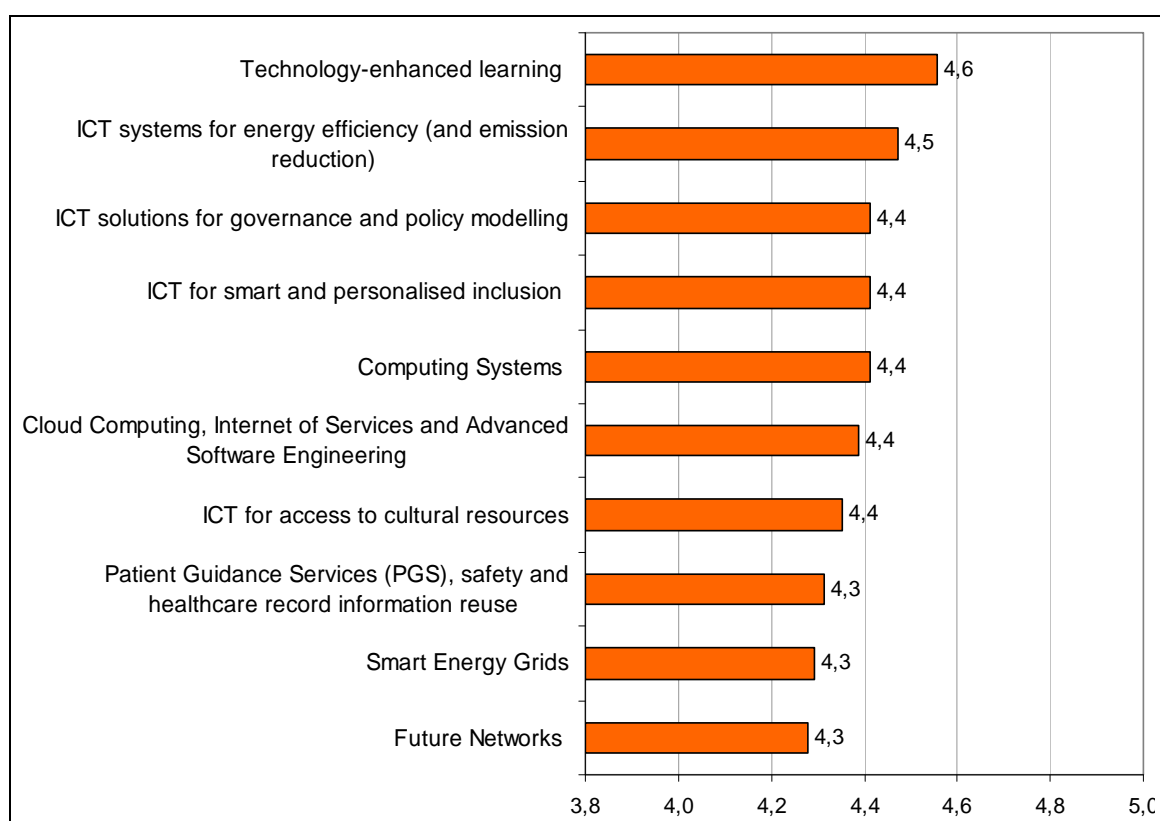
¹⁶ PRO-IDEAL- Report on ICT Research Priorities in Latin America. September 2010

5.2 Priorities for International Cooperation with Europe

The survey conducted by the PRO-IDEAL consortium in June 2010 detected that the national priorities seems to be in line with the EC FP7-ICT programme, identifying that the top ten ICT priorities in LA refer to education and learning, communication networks, information management, computing systems, energy, cultural resources, governance and health. Nevertheless, there are five ICT priority areas identified by the study, for potential cooperation on which the PRO-IDEAL countries have been focused:

- Internet of Services, Software and Virtualisation
- Nanoelectronics Technology
- Technology-Enhanced Learning
- ICT for Patient Safety
- ICT for Governance and Policy Modelling

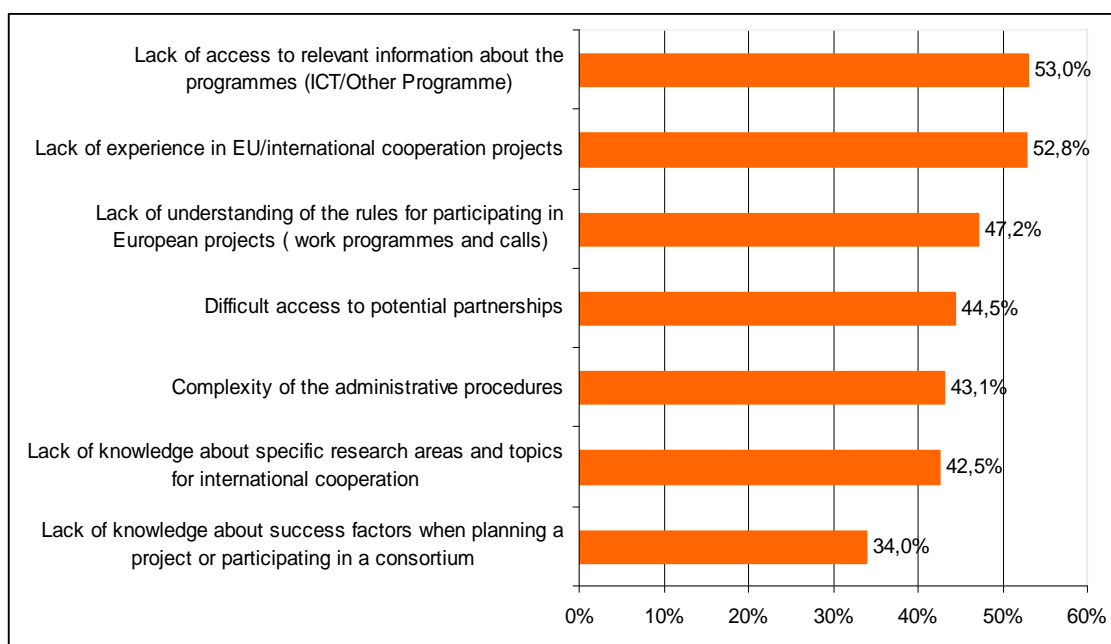
In the following chart, the top 10 ICT research priorities in Uruguay identified by the survey are presented:



Source: PRO-IDEAL Survey, 2010

The PRO-IDEAL survey also exposed some barriers to be overcome in the near future regarding Latin American participation in EU projects, mainly those related to the access to key information about the ICT programme, understanding of the rules for participating and partnership, as well as the insufficient experience in EU/international cooperation projects. These barriers are common to all PRO-IDEAL target countries, including Uruguay.

The following graphic refers to the obstacles to participate in ICT R&D cooperation projects with Europe, perceived by the respondents of the survey.



Source: PRO-IDEAL Survey, 2010

To this respect, current actions undertaken by PRO-IDEAL and PRO-IDEAL PLUS projects to enhance international cooperation in ICT R&D have been validated by the survey. Also, there is consensus around the need to enhance the ICT policy dialogue between Latin America and Europe, selecting ICT priorities for research cooperation and training people to promote ICT research benefits.

Concerning International funding, Uruguay receives a great amount of financing from the IDB and the bilateral programs, which indicates a huge potential for national researchers to benefit from the EC programmes, as several LA countries like Brazil (64%) and Colombia (51%) do.

| | Argentina | Brazil | Colombia | Costa Rica | Cuba | Chile | México | Uruguay |
|---------------------------|-----------|--------|----------|------------|--------|--------|--------|---------|
| FP6 | 7,1% | 21,4% | 10,3% | 13,6% | 0,0% | 0,0% | 9,3% | 0,0% |
| FP7 | 14,3% | 28,6% | 20,5% | 13,6% | 0,0% | 16,7% | 18,6% | 11,1% |
| UE (Other) | 7,1% | 14,3% | 20,5% | 9,1% | 0,0% | 33,3% | 18,6% | 11,1% |
| IDB | 28,6% | 14,3% | 23,1% | 40,9% | 0,0% | 33,3% | 7,0% | 50,0% |
| Bilateral Programs | 42,9% | 21,4% | 25,6% | 22,7% | 100,0% | 16,7% | 46,5% | 27,8% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

Source: PRO-IDEAL Survey, 2010

5.2.1 Survey on ICT R&D Groups in Uruguay

In addition to the survey on ICT Research Priorities in Latin America, a review on the groups working in ICT R&D on behalf of Uruguay and their main lines of work was conducted by LATU.

To produce the data shown below, key members of the groups working in ICT R&D received a questionnaire aimed at collecting a minimum set of relevant data. The survey included a reduced number of questions to encourage as much feedback as possible.

The questions were:

1. *Group name and brief description (if possible in less than one page).*
2. *How long have you been working in the group and how many people work there?*
3. *Linkages of the group with other academic groups (both in UY and abroad)*
4. *Linkages of the group with other business sectors (both in UY and abroad)*

The people interviewed were qualified informants of the institutions below, who conduct research activities in Uruguay: Computing Institute and Electrical Engineering Institute of the University of the Republic; School of Engineering of ORT University and School of Engineering of the Catholic University.

The initial aim was to survey the companies that host formal research groups. With the help of the Uruguayan Chamber of Information Technologies (CUTI) a group of ICT companies were identified, but on the basis of the results of the first four interviews, this line of work was not followed further, as it became clear that there are no ICT companies in Uruguay with identifiable research groups that are not directly involved in development activities as well. It is hard to separate research activities from activities aimed at keeping the company's developments updated, according to state-of-the-art criteria. Furthermore, in contrast to the academic research groups, the private sector is usually reluctant to disclose their lines of research.

Results

The survey included all the groups mentioned by the qualified informants (feedback was received from 80% of them). Some of the groups might be 'over represented', as some of the groups that are currently at very early stages of development may not succeed in achieving sustainability. Finally, the results of this work by no means intend to be exhaustive, but merely representative of the existing research groups. The results of the survey are grouped by area.

Groups Working in Electronics

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|-----------------------------------------|---------------|--------------------|---------------------------------------|----------------------------------------------|-------------------------------------------|------------------------------------------|
| GME | 14 | 19 | Microelectronics | Institute of Electrical Engineering - UDELAR | EU, LA | CCC, Milagro, Nanowat, ICTs, Neurostream |
| μDIE | 7 | 6 | Microelectronics | Catholic University (UCUDAL) | European and groups Union Brazilian | CCC, Genius (Brazil) |
| Optoelectronics and applied electronics | 4 | 6 | Sensors, data acquisition | Catholic University (UCUDAL) | | Ingener, Nette |
| Applied electronics | 12 | 14 | Digital electronics, data acquisition | Institute of Electrical Engineering - UDELAR | European Union, Brazil | Antel, LATU, IMM, AFE |

Groups Working in Signals – Images

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|-------------------------------|---------------|--------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------|-------------------------|
| Audio processing group | 6 | 5 | Audio | Institute of Electrical Engineering - UDELAR | European Union, Latin America | Measurements and Market |
| Biomedical Engineering Nuclei | 22 | 26 | Development of medical devices and systems based on detected clinical unmet needs and technological opportunities | School of Engineering, School of Medicine - UDELAR | Latin America | Controles, Biogenesis |
| Images Treatment Group | | | Research and development related with biological applications (part of NIB) | | European Union, USA | INIA, DNIC, SUL, |

Groups Working in Software Engineering

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|-------------------------------------------------------|----------------------|---------------------------|------------------------------------------------------------------------------|------------------------------------|--------------------------|--------------------------------|
| GrIS | 9 | 9 | Software engineering group | Computing Institute (UDELAR) | Spain, USA | Several in the processes areas |
| Software engineering research group | 4 | 4 | Software engineering | ORT University | European Union | |
| Software engineering research group | 3 | ¿? | Software Measurement | Catholic University (UCUDAL) | | |
| Applications Integration Methodologies Research Group | 3 | ¿? | Creation, Specifications and Development of integrated Software Environments | Catholic University (UCUDAL) | | |
| Language Theory Research Group | 3 | 3 | Language theory applied to the development of software | Catholic University (UCUDAL) | Spain | |
| Software Testing Center | ¿? | 4 | Testing | Computing Institute (UDELAR), CUTI | Spain | Several customers, Abstracta |

Groups Working in Networks – Telecommunications

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|-----------------------------------------|---------------|--------------------|--------------|----------------------------------------------|---------------------------------|-------------------------------|
| ARTES | 12 | 8 | Networks | Institute of Electrical Engineering (UDELAR) | European Union, Latin America | Antel, Ceibal, MIEM, Movistar |
| Telecommunications -applied mathematics | 7 | 5 | Networks | Catholic University (UCUDAL) | _USA, European Union, Australia | Antel, Ceibal |

Groups Working in Models

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|---------------------------------|---------------|--------------------|------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------|-------------------------|
| Operational Research Department | 8 | 20 | Network modeling and optimization, urban bus transportation, stochastic and combination optimization | Computing Institute (UDELAR) | European Union, Latin America | Several |
| Systems and control group | 8 | 6 | Models, traffic | Catholic University (UCUDAL) | European Union, Latin America | LATU |

InCo Historical Groups

These groups are not related because of their fields of activity, but are directly related with the various departments at InCo.

| Project Name/Program me | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|--------------------------------|---------------|--------------------|------------------------------------------------------------------------------------------------|------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Data Calculation Center | 14 | 22 | Parallel computing techniques distributed in high performance IT infrastructures | Computing Institute (UDELAR) | European Union, USA, Latin America | Several |
| PLN | 8 | 14 | Natural language processing | Computing Institute (UDELAR) | France, Latin America | Parliament |
| Systems Integration Laboratory | 9 | 12 | Integration of IT systems based on middleware technologies / platforms for digital integration | Computing Institute (UDELAR) | European Union, Colombia | Microsoft, IBM and others in middleware platforms. Manos del Uruguay, FEMI, BPS and other digital inclusion projects |

Other Groups

| Project Name/Programme | Group members | Years of Existence | ICT R&D Area | Leading Institution | Academic linkages | Private Sector Linkages |
|-------------------------------------------------------------|---------------|--------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|--------------------------|
| Quantic Computing | 2 | 3 | Quantic Computing | ORT University | Spain | |
| Smart Systems Applied to Support the Clinical Diagnosis R.G | 5 | | Automated learning and reasoning techniques to support the clinical diagnosis and treatment of medical conditions | Catholic University (UCUDAL) | Spain | Hospital Pereira Rossell |
| Business Processes Automation Research Group | 4 | | Business Processes Automation Management | Catholic University (UCUDAL) | | |
| Geographic Data Systems Research Group | 3 | | Computing Algorithms Geographic Data Systems | Catholic University (UCUDAL) | | |

New Groups

Two additional groups detected are in the process of creation. One is at the ORT University, in the area of Knowledge Management and the other one at UCU in the Systems, Storage, Security and Simulation fields.

Highlights

The results of the survey underscore the following aspects:

- The groups are relatively small, the biggest ones have 22 members (Calculus Center, Biomedicine Engineering)
- Several horizontal relations were found: the groups are usually interrelated even when they may belong to different institutions
- There are few academic linkages with the USA, and relatively strong linkages with the European Union.
- There are relatively low linkages with private companies.

Contacts

Below is a table with the addresses of the contacts supplied by the groups:

| NAME | Contact |
|----------------------------------------------|------------------------------------------------------------|
| ARTES | Pablo Belzarena <belza@fing.edu.uy> |
| Audio processing group | Martín Rocamora <rocamora@fing.edu.uy> |
| μDIE | Alfredo Arnaud <aarnaud@ucu.edu.uy> |
| Telecommunications -applied mathematics | Fernando Paganini <paganini@ort.edu.uy> |
| Optoelectronics and applied electronics | Daniel Perciante <dpercian@ucu.edu.uy> |
| Software engineering research group | Martin Solari <martinsolari@gmail.com> |
| Applied electronics | "Juan P. Oliver" <jpo@fing.edu.uy> |
| Systems and control group | Enrique Ferreira <enferrei@ucu.edu.uy> |
| Quantics Computing | buksman@ort.edu.uy |
| Data Calculations Center | Sergio Nesmachnow <sergion@fing.edu.uy> |
| GrIS | Jorge Trinanes <jtrinanes@gmail.com> |
| μDIE | Alfredo Arnaud <aarnaud@ucu.edu.uy> |
| GME | Fernando Silveira <silveira@fing.edu.uy> |
| Business Processes Automation Research Group | Ernesto Ocampo Edye <eocampo@ucu.edu.uy> |
| Software Engineering Research Group | Ernesto Ocampo Edye <eocampo@ucu.edu.uy> |

| NAME | Contact |
|-----------------------------------------------------------------|---------------------------------------------|
| Applications Integration Methodologies Research Group | Ernesto Ocampo <eocampo@ucu.edu.uy> Edye |
| Geographic Data Systems Research Group | Ernesto Ocampo <eocampo@ucu.edu.uy> Edye |
| R.G. on Smart Systems Applied to Support the Clinical Diagnosis | Ernesto Ocampo <eocampo@ucu.edu.uy> Edye |
| Biomedical Engineering Core | Franco Simini <simini@fing.edu.uy> |
| Images Treatment Group | Gregory Randall <randall@fing.edu.uy> |
| Operational Research Department | Omar Viera <viera@fing.edu.uy> |
| Systems Integration Laboratory | Raul Ruggia - INCO <ruggia@fing.edu.uy> |
| Knowledge management | Ines Kereki <kereki i@ort.edu.uy> |
| Systems, Storage, Security, and Simulation | Thomas Schwarz <tjschwarz@scu.edu> |
| CES | Raquel Abella <rabella@ces.com.uy> |

6 CONCLUSIONS

ICT has turned in the last 30 years into one of the most relevant activities in Uruguay. As a whole, the industry comprises more than 300 software companies, integrators, hardware vendors and connectivity providers, employing more than 10,000 people; its products are exported to 52 countries.

As the internal market is small, many companies devote their efforts to develop regional and global markets. There is full employment in the ICT industry, and local universities are not producing enough professionals to satisfy the industry demand. As a strategy, CUTI is supporting programs aiming to attract high school students into careers related to ICT.

Uruguay has strongly pushed for policies oriented to provide universal access to the Internet. Plan Ceibal, the local version of the One Laptop per Child program, has completed the distribution of laptops to every student in the public school system, and is now targeting the high school segment. Ceibal has already produced a high impact in several aspects of the society, including communications infrastructure and reducing the digital divide. Ceibal is also promoting R&D activities in connectivity and digital educational content.

Regarding the public institutional structure for the development of ICT, in the last few years an improvement in the conditions for research and innovation in the country, as well as in the coordination between the different stakeholders in ICT has been noticed with the creation of two key institutions: ANII and AGESIC. ANII is in charge of coordinating the R&D activities, having developed recently several programs to promote research and innovation. Those programs are used extensively by the ICT sector. AGESIC targets access of citizens to electronic services in the public sector, and is responsible for the electronic government programs and for the development and execution of the Digital Agenda. It is also responsible for the management of new laws on ICT subjects, such as digital signatures, protection of personal data and access to public information.

In the academic sector the engineering departments of three universities (UDELAR, ORT University and Catholic University), concentrate the teaching as well as the R&D activities in ICT. Public policies promote ICT R&D activities generically, but there are no specific guidelines regarding particular lines of work, but analyzing the specific actions carried out by the institutions active in R&D, some priorities can be identified, including digital educational content, ICT applications in agro-industrial chains, mobile applications, logistics and transportation.

The survey on ICT R&D groups in Uruguay highlighted some common aspects of the teams working in that area. A high interaction with European Union academic R&D groups is evident, and fewer academic linkages with US were noticed as well. The groups belonging to different universities are well connected and there is a fair level of interaction between them.

7 REFERENCES

7.1 Policy Documents and Surveys

- National Strategic Plan for Science, Technology and Innovation (PENCTI) (¹ http://www.anii.org.uy/web/static/pdf/PENCTI_Decreto.pdf)
- Investment Law (Ley de Inversiones): (<http://www.parlamento.gub.uy/leyes/AccesoTextoLey.asp?Ley=17555&Anchor=>)
- Digital Agenda (Agenda Digital 2008-2010): (http://www.agesic.gub.uy/innovaportal/file/447/1/agenda_digital2008-2010.pdf)
- ANII funding instruments for ICT projects: (<http://www.cuti.org.uy/documentos/instrumentos-financiamiento2011.pdf>)
- CUTI 2009 anual survey on ICT industry: (<http://www.cuti.org.uy/documentos/Resultados-Encuesta-Anual-Cuti-datos-2009.pdf>)
- The Uruguayan Software Market: (http://www.cuti.org.uy/documentos/software_uruguay.pdf)
- ICT use in Uruguay: (http://www.cuti.org.uy/documentos/Pittaluga_Utilizacion_de_las_Tecnologias.pdf)
- Strategies for ICT industry development in emerging markets: (http://www.cuti.org.uy/documentos/Brum_Trayectorias_Ventanas_y_Nichos.pdf)
- The software and ICT services sector in Uruguay: (http://www.cuti.org.uy/documentos/Gonzalez_Pittaluga_Sector_de_Software_y_Servicios_Informaticos_en_Uruguay.pdf)

7.2 List of Institutions and Companies Interviewed for this Report

- National Agency for Research and Innovation (ANII) – Executive Director.
- Agency for the Development of Electronic Government and Knowledge and Information Society (AGESIC) – Executive Director and ICT National Contact Point
- Business Chamber of ICT companies (CUTI) – *General Manager*
- Computing Institute, National University – UDELAR (INCO) - *Director*
- Electrical Engineering Institute, National University – UDELAR (IEE) - *Director*
- School of Engineering, ORT University – *Dean*
- School of Engineering, Catholic University (UCUDAL) – *Dean*
- Artech – Genexus – *Director*
- Ricaldoni Foundation – School of Engineering, UDELAR – *Director*
- Ingenio Business Incubator – *Director*

8 GLOSSARY

- **AGESIC:** Agency for the Development of Electronic Government and Knowledge and Information Society (<http://www.agesic.gub.uy>)
- **ANII:** National Agency for Research and Innovation (<http://www.anii.org.uy>)
- **ANTEL:** Public Telecommunications Company (Administración Nacional de Telecomunicaciones, <http://www.antel.com.uy>)
- **CERTUy:** National Response Center for Information Security Issues (<http://www.cert.uy>)
- **CUTI:** Business Chamber of ICT companies (<http://www.cuti.org.uy>)
- **EU:** European Union
- **FI/FM:** School of Engineering/School of Medicine (UDELAR)
- **IEE:** Electronics Engineering Institute (UDELAR)
- **InCo:** Computing Institute, National University (<http://www.fing.edu.uy/inco>)
- **INIA:** National Institute of Agricultural Research
- **LA:** Latin America
- **MGAP:** Ministry of Livestock, Agriculture and Fishery
- **ORT:** ORT University Uruguay
- **PENCTI:** National Strategic Plan for Science, Technology and Innovation
- **SNI:** National Researchers System
- **UCUDAL:** Catholic University
- **UDELAR:** National University (Universidad de la República)