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The Evolving Role of Academic Institutions in Innovation Systems and Development

Uruguay: Higher Education, National System of Innovation and Economic Development in a Small Peripheral Country

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Uruguay: Higher Education, National System of Innovation and Economic Development in a Small Peripheral Country

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Presentation

This paper aims to describe the general framework for the Uruguayan contribution to a comparative research project – in brief the UniDev Project -, initiated and coordinated by the Research Policy Institute of the University of Lund, concerning the role of Universities and other Academic Institutions in Development.

Section 1 summarizes the historical evolution and actual situation of Uruguay, a small peripheral country with comparatively high levels of Human Development. Section 2 focuses specifically in the Uruguayan National System of Innovation (NSI); it organizes the empirical elements in a theoretical approach to the study of Systems of Innovation (SIs) by means of “constructive modules” and discusses some of such modules. Section 3 offers a preliminary mapping of the Uruguayan Academic System, discussing the modules of the Uruguayan NSI related to it; particular attention is paid to the University of the Republic (UR), by far the most important institution of Higher Education in the country, that will be the subject of the main case study of the Uruguayan contribution to the UniDev Project. Section 4 describes the current debate in Uruguay concerning Higher Education and its external relations. Section 5 sketches main issues for future research, connected with exploring the notion of Developmental University.

1. Introduction to the Uruguayan context

Uruguay is a small South American country, with a surface of 176.000 square kilometres and a population slightly over 3.200.000 inhabitants. It is also quite atypical in the Latin American context, as it follows from some of its basic features that are briefly recalled in this introduction.

During the second half of the 19th century Latin America began its integration in the “center-periphery” system, as an exporter of primary products and importer of industrialized goods. That was the main force during the so-called outward growth period (circa 1850-1930). Uruguay’s peripheral insertion was early and quite successful. A main explanatory reason is that the country has been well placed in the “commodity lottery” (Bulmer-Thomas, 1994: 15): its main exports are based on cattle raising, and such products have quite significant linkages – stimulating industry and urbanization - as well as relatively high international income elasticities of demand. Those factors help to explain why Argentina and also Uruguay around 1900 were comparatively rich and growing quickly.

By that time the Uruguayan population was almost a million, having grown from around 150.000 in 1850; the small aboriginal population had been almost liquidated long before and a strong immigration from Europe was taking place. Uruguay is perhaps the best Latin American example of what Darcy Ribeiro called a “transplanted people” – *un pueblo transplantado*.

Integration of immigrants was facilitated by the early extension of public, free, compulsory and laic elementary education. The system was created by a law in 1877 and high priority was assigned to it in the following decades. Illiteracy diminished quickly. After 1900 public secondary education was fostered, not only in Montevideo – the capital city, the main port and the economic, political and cultural center, where more than 40% of the population lives - but also in the rest of the country. Tertiary public education also grew significantly, but it was and still is essentially concentrated in Montevideo. Uruguay has traditionally been proud of its educational system; that feeling is not without solid justifications, mainly related with elementary schooling, but most of them belong more to the past than to the present. And even in the past the system had several flaws; the main ones have been closely related with the low social and cultural valuation of manual work and technical activities, a main aspect of the Ibero American tradition. Technical education has always been the neglected component of Uruguayan education.

Nevertheless, a century ago the country was ready for success. Immigration was fostering some degree of technical progress and an early industrialization. The introduction of well known techniques for cattle raising as well as innovations related with the transport of frozen meat led to an export boom. Peace in rural areas became essential for business. The long history of civil wars came to an end. Cattle was not labor demanding. Urbanization advanced quickly, as well as public services, light industries and mass politics. A liberal democracy emerged. Immigrants brought not only technical know how but also trade-unionism. Even if mainly concentrated in Montevideo, a quite “modern” set of social relations emerged.

Such were the main basis of a phenomenon that deserves attention because, even if greatly transformed, it still dominates the Uruguayan political and ideological landscape: the *batllismo*. Originally, the word denominated the political movement related with José Batlle y Ordóñez, who was president in 1903-1907 and in 1911-1915. The second of the four Uruguayan presidents belonging to the same family, he was the main promoter of a pioneer welfare state, a remarkable Keynesian social democracy *avant la lettre*. It included advanced social legislation as well as an extended systems of public owned utilities and industrial firms. Such “batllista state” became the main original trait of the small peripheral country Uruguay; to consolidate and expand the characteristic functions of the batllista state was and is what the majority of the population demands from the political system; the ups and downs of the batllista way of governing characterize the contemporary history of Uruguay.

During the founding period – the first decades of the 20th century -, the economic performance of the “batllismo” was modest, but its social and political achievements were really important (Finch, 2005: 27). In fact, something similar can be said of what happened after. Those achievements were economically based on the exports stemming from cattle production, which the batllismo was unable to improve. When external income diminished abruptly in the 1930s, the first batllismo came to an end, an important social and political turn took place, and the government became dictatorial for the first time in the century. At that time Latin America was starting a new stage in its economic history, an inward-led growth period based on the Industrialization by Substitution of Imports (ISI). In Uruguay that type of growth had already a quite strong base; it acquired momentum in the 1940s, when the “commodity lottery” was becoming favorable once more, as it stayed up to the second half of the 1950s, mainly due to the external demand connected with the II World War and the Korean War. A “second batllismo” emerged, greatly expanding the state-owned productive sector and the Social Security System. Around 1950, Uruguay saw itself and was seen from abroad as a

“model country”: quite prosperous, pacific, and far less unequal than the Latin American average. Greatly idealized, that “model country” of yesterday is still highly influential today in the Uruguayan “collective imaginary”.

The political history of Uruguay in the 20th century can be divided in two periods of roughly 50 years each (Filgueira et al, 2003): the first one is characterized by the systematic expansion of the social and economic role of the state, the second one by a conflictive and contradictory process of decreasing state intervention.

The limits to an inward industrialization in a small country, the lack of technical progress in Uruguayan agrarian production and the decreasing international prices for primary products originated, in the late 1950s, an economic stagnation that lasted for around 15 years. During that period Uruguay changed from an immigration to an emigration country. Political changes and social unrest followed. The government turned to the right, leaving aside social democratic policies and adopting a repressive attitude; trade unions resisted that trend, the left became more important, guerrillas appeared. Step by step, a dictatorial government was built, culminating with the dissolution of Parliament in 1973; for more than ten years, Uruguay lived under a military regime, by then a common situation in the South of Latin America.

That regime started opening, deregulating and liberalizing the economy; it aimed at an outward-led growth, based on diminishing salaries and social aids as well as on export-promotion. Important changes took place but, with the great debt crisis of the early 1980s, production fell abruptly and people below the line of poverty increased to 46%, an almost incredible figure in the Uruguayan context. Social opposition to the military increased; almost all the political spectrum demanded the end of the dictatorship; a difficult transition took place; on March 1985 a democratically elected government took office.

It can be said that in the last twenty years the main problem has been how to combine a restoration of the batllista welfare state – strongly demanded by the majority of the population – with the search of new sources of economic growth.

That combination showed some possibilities, at least up to the late 1990s¹. In the decade following 1985, poverty and inequality diminished. By 1995, Chile was the success story of South America in economic terms and Uruguay in social terms. The material basis of such progress was mainly a favourable relation with the two big neighbors, Brazil and Argentina, and the easy access to international financing that characterized the period 1990-1997; raising public expenditures and persistent trade deficit were managed by means of a growing external debt. In 1991 the MERCOSUR treaty (Mercado Común del Sur, Common Market of the South) was signed by Argentina, Brazil, Paraguay and Uruguay; some years later, more than half of the external trade of Uruguay took place with its neighbors, exports being fostered by the overvaluation of Brazilian and Argentinean currencies.

Meanwhile, Uruguayan governments tried to implement a somehow weakened version of the Washington Consensus policies. Opening and deregulating the economy was continued, but privatization was almost stopped: the first and comparatively timid attempt in that direction was submitted to a referendum, and 72% voted against it; the “Uruguay batllista” was as strong as ever.

The economic situation changed in the late 1990s. For Latin America as a whole, ECLAC asserted that 1998-2002 was a lost half decade. That was particularly true for Argentina and Uruguay. A great crisis took momentum in Uruguay in 2002, exactly 20

¹ Concerning different aspects of the period 1985-2005, a good reference is the collective volume Caetano (2005).

years after the last one; bankruptcy exploded, the public debt soared, unemployment rose to 20%, production receded 20% in two years, external migration rose again.

The crisis accelerated a political change already underway. A broad coalition of left and center-left political organizations, the *Frente Amplio* – the Wide Front – was founded during the agitated years that led to the military coup; it became the most active component of the political opposition to the dictatorship; its electoral support rose steadily since the return to democracy. While the traditional parties adopted a more or less neoliberal discourse, the Frente Amplio became increasingly identified with the batllista tradition. In 2004 it obtained 50,7% of the votes. In 2005, for the first time in history, a left wing government took office in Uruguay.

In that year, the GDP reached again the level of 1998. Economic recovery has been fuelled by international trends, particularly the rising prices of commodities. The “commodity-lottery” is again favorable for Uruguay: exports are increasing quickly; meat accounts for 25% of external sales, particularly to the very affluent market of the United States; other products have also good prospects, particularly wood and paper. In spite of the recent crisis, Uruguay has a high Human Development Index and is the less unequal country of South America. Nevertheless, unemployment is still around 10%, 27% of the population is below the poverty line, approximately 4% of GDP is dedicated to paying the interests of external debt, trade deficit looks solid again, and investment is scarcely over 15% of GDP.

This section aims to sketch the context for analyzing the relations between knowledge production and economic development in Uruguay. A main empirical fact is that in the long term growth has been slow in Uruguay. It averaged in 1960-1998 in Uruguay 0.9% and in USA approximately 2%, so “between 1960 and 1998 Uruguay’s per capita income fell from 28.3% of the US average to 19.0%. [...] roughly speaking long run per capita growth has averaged about 1 percent which implies that the country has been growing less than the technological frontier over a long period of time.” Low investment is evident; it averaged 15.4% for the “relatively benign decade of the 1990s”. (Hausman et al, 2004: 7)

In fact, investment possibilities are not absent: meat, rice, soybeans, forestry, pulp and paper, ports, tourism, software, the export of business services, are seen as having large growth potential (Op. cit.: 4). Other sectors could also be mentioned, including some with high technological content and directly connected with the basic national production, like biotechnology for animal health.

To discuss if such potential can change the long term pattern, the key distinction between economic growth and economic development must be recalled. Strangely, this well known distinction is often overlooked, at least in Latin America. In his “Theory of Economic Development”, originally written in 1911, Schumpeter made the distinction between the mere growth of the economy, that reflects material and demographic growth, and [economic] development, that only exists when new combinations of productive means take place (Schumpeter, 1957: 74-76). Such new combinations, or innovations, increase the knowledge content and the value added in the production of goods and services; this is the core of economic development.

A related and fundamental assertion is that: “As has been repeatedly observed over the last few centuries, the common problem faced by all catch-up economies is that the shift to higher value-added activities, which constitutes the key to the process of economic development, does not happen ‘naturally’.” (Chang, 2002: 126)

Economic growth has been slow in Uruguay because investment has been low and because economic development has been very weak. Bértola and Bittencourt (2005)

characterize the last two decades as “twenty years of democracy without economic development”.

A new start is taking place in Uruguay, politically and perhaps also economically. The new government has its own parliamentary majority and a wide public support; it has promised important reforms. Changes can be seen in the insertion in the world economy. Alternative strategies are hotly debated. It can be said that a “third batllismo” is being shaped. A fundamental question is if it will have only the weak basis of a commodity-exporting economy or if it will have the stronger support stemming from a gradual turn towards a more knowledge-based and innovation-driven economy.

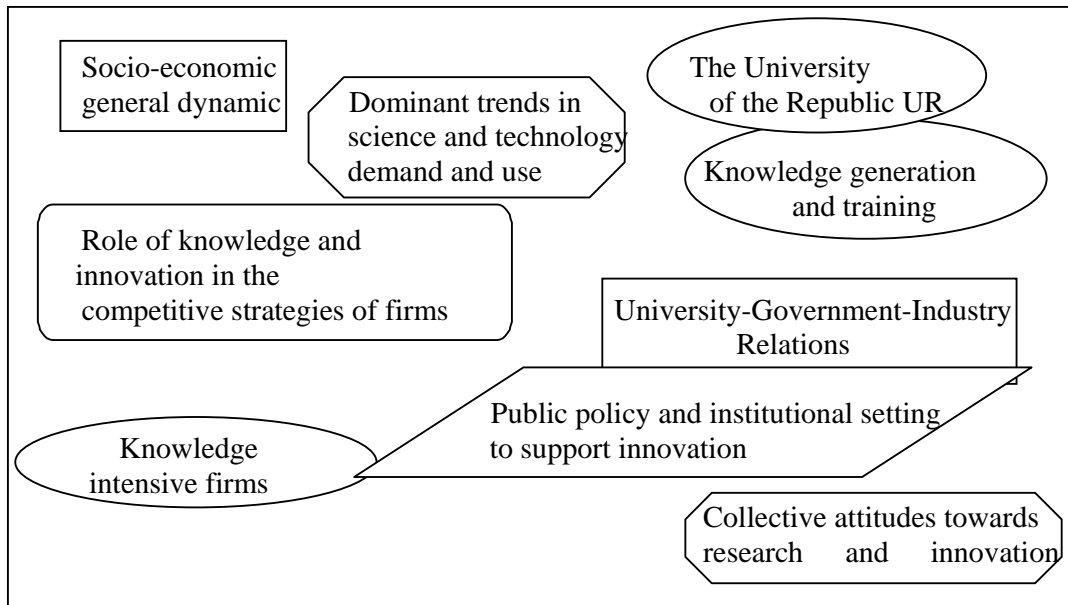
2. The Uruguayan National System of Innovation: a characterization by constructive modules

Universities cannot deploy their potentialities and even less transform themselves in isolation. What they can do depends both on their internal structure and on the world outside them. Their impact as providers of knowledgeable people and of research results is highly dependent on the way the society as a whole interacts with knowledge. This is why a useful way of analyzing the role of universities in development is to embed such analysis into the system of innovation framework. As Lundvall put in a paper delivered at a World Bank Conference of Economic Development, “A general conclusion is that the role of higher education needs to be assessed in the wider context of the national innovation system and that higher education policy needs to be coordinated with a wider set of innovation policies”. (Lundvall, 2007) This is why we shall present some main characteristics of the Uruguayan System of Innovation, as a way to have a broader picture of the landscape in which universities live and evolve.

Any useful characterization of a NSI needs to fulfill two requisites: first, to allow national specificity to be accurately taken into account, and second, to allow meaningful comparisons with other NSI. A methodological procedure to achieve this is to construct a “picture” of NSI by means of constructive modules, each of which helps understanding a key factor or situation; the combination of the different modules approaches the variety of the NSI. (Arocena and Sutz, 2000) The assessment of the linkages between the different modules completes the construction of the picture by showing to what extent we have an integrated picture or a set of more or less isolated parts. National specificity is reflected in the choice of the constructive modules; international comparisons can be built “bottom-up”, from comparisons between the constructive modules that are considered in different characterizations.

Nine constructive modules were selected for the Uruguayan case as sketched in Figure 1: five of them will be briefly discussed in this section and four of them, more directly related to the academic system, in the next one.

Figure 1.- Constructive modules to characterize the Uruguayan NSI



Socio-economic general dynamics

Two of the most salient characteristics of the Uruguayan socio-economic dynamics are the lasting low levels of productive investment, a figure that has been below 15% for the last decades, and an export structure mainly based on the good endowment of natural resources with relatively low value added. Uruguay has received traditionally little Foreign Direct Investment (FDI), a feature that seems to be changing rapidly around the forestry industry, given the big current investment on cellulose mills.

With the arrival of the new government in 2005, some changes in the current situation might be expected. The market fundamentalism of former administrations seems to be tempered, and the need for some type of active policies to build a “productive country” has been recognized. A stronger innovation climate has been included as one of the main objectives to be achieved during the five years mandate and public policies to achieve that aim are being devised.

The extraordinarily good conjuncture in terms of international prices for commodities, in some of which, like meat and dairy products Uruguay excels, can be an opportunity to support a long term investment in knowledge and innovation policies. If this is achieved the universities will receive a stronger demand than ever, given the wide opportunities to apply new knowledge and to develop new technologies to add value to the traditional productive sectors and, even, to develop independent new industrial sectors.

Role of knowledge and innovation in the competitive strategies of industrial firms

An “aerial” view of this issue can be approximated by innovation surveys. The analysis of the last innovation survey conducted in the country, covering the period 2001-2003, shows that three quarter of all firms have low or non existent innovative intensity. (Bianchi and Gras, 2005)

The linkages with the NSI are weak in relation to R&D activities but are relatively widespread concerning technical tests and information gathering, as can be seen in Table 1. It is interesting to note that the proportion of firms declaring linkages with different parts of the NSI is much higher among the innovative firms.

Table 1.- Linkages with the NSI in the Uruguayan industry 2001-2003

Linkages with the NSI related to	% of firms declaring innovation activities having linkages(1)	% of firms without innovation activities having linkages
R&D	10,4	1,3
Other innovation activities (2)	61,6	24,4
Training	37,2	8,0
Financing	25,4	21,3

Source: Based on Bianchi and Gras, 2005. (1) 36,6% of all firms in the Industrial Innovation Survey 2001-2003 declared to have introduced innovations during the period; (2) Other innovation activities include consultancy in organizational change, tests, technical assistance and design. Note: Institutions of the NSI include universities, technological centers, institutions for technical training, clients, other enterprises, consultants, suppliers, financing entities, governmental agencies related to S&T.

The most important innovation activity indicated by firms that declared innovations during the surveyed period was, by far, the acquisition of machinery and equipment -over 80% of all investment in innovation- which explains why activities like testing and technical assistance, probably conducted by representatives of foreign providers, occupies such a prominent place.

In terms of internal R&D, less than 20% of firms declared performing R&D, but almost 60% of them indicated that not a single person with higher education training was assigned to it.

These are only a few features coming from innovation surveys that confirm the general weakness of the country's innovative landscape, but precisely because its general nature they add little focused information. The latter is very important, though, because the firms that are truly innovative, use knowledge as a productive tool and strengthen their cognitive base by hiring and training highly qualified personnel, can be a key vector of innovation for the whole economy. To this point relates the next module.

Knowledge intensive firms

A case study of the Uruguayan professional electronic industry (Snoeck, Sutz, Vigorito, 1992) showed the role played by high-tech firms in the export capacity of the country: main private clients of the electronic industry were big exporters that needed ad-hoc solutions to improve their competitiveness or to fulfill external requirements. Other example of this type relates to the meat industry, where locally designed biotechnological vaccines were able to fight efficiently against cattle diseases that hamper exports, like the foot and mouth disease. That is, even if electronic or biotech firms are quite weak exporters themselves, they greatly contribute to exports in an indirect way. In more general terms, this can be seen in Table 2, where the exports of a sample of firms that includes knowledge users and knowledge producers are depicted: more than 90% of all exports were done by the user firms. The big exception is the software industry, that exports fairly well; it is worth noticing the contribution of the biotechnology firms to the exports of their users firms.

Table 2.- Exports by knowledge-based firms and by their clients, 2000 (%)

	Knowledge producers (knowledge-based firms)	Knowledge users (clients of knowledge-based firms)
Software	82,1	2,5
Biotechnology	6,1	43,2
Entrepreneurial engineering services	-	37,8
Environment	0,6	16,4
Pharmaceutical	11,2	-
Total exports by category	100	100
% of total exports in the sample	8,5	91,5

Source: based on Pittaluga et al, 2005: 213.

It is interesting to note that for establishing linkages with knowledge providers firms seem to need qualified personnel: the proportion of qualified personnel of the knowledge-users firms was 15% in 2002, a much higher figure than the one for the general industry, around 3,5% at that time. This points to the key contribution, from the supply side, made by research universities to the absorptive capacities of firms.

Public policy and institutional setting to support innovation

It is a shared understanding that public policies devoted to support innovation have been historically weak in Uruguay. First of all, the level of investment in R&D has been particularly weak, always below 0.3% of GDP. Besides that, some important policy instruments have been also weak or non existing, like technology and industrial extensionism, government technology procurement or the systematic elaboration of statistics and studies on science, technology and innovation to better inform policy design. On the other hand, some canonical instruments, like subsidies to firms for innovative activities coming from international loans, have usually been underused, mainly due to complicated application mechanisms.

Strong specialized centers of technology to support productive sectors have existed until now only in the agrarian sector, but new institutions related to software with encouraging prospects are emerging and other institutions, like technological incubators, have been put in place very recently.

The current situation is particularly fluid and policy initiatives related to innovation and knowledge production are being discussed and implemented: universities as well as other knowledge related institutions will need to develop new strategies to participate in the new policy settings.

Collective attitudes towards research and innovation

NSIs, as well as innovations, develop in a cultural milieu. What people think about science and technology sets the scenery where different efforts towards innovation take place. Several key attitudes can be traced back to public perception of science and technology. The willingness of the youth to pursue scientific and technical careers, how businessmen perceive the importance of hiring highly competent

personnel, the drive of young professionals towards starting their own knowledge based firms, are a few examples of such attitudes.

An approach to this issue in Uruguay was made in 1996 and repeated in 2003 (Arocena, 2003). For instance, people were asked to choose between three “policy alternatives”: (a) Uruguay can and must do research with public funds, because benefits will be greater than costs; (b) Uruguay can do successful research but must not do it, because costs will be greater; (c) Uruguay cannot do successful research. In 1996, 55% of the population chose the first alternative, in 2003, in the middle of the most severe economic crisis in twenty years, 51% of the population still chose the first alternative. This implies that a fair proportion of the population truly sees research as a tool for national development that deserves public support. This result is in tune with the wide expectations that people put in the Universidad de la República, the institution where research activities are concentrated (Bortagaray, 2006)

3. Mapping the Academic System in Uruguay: an overview

Basic information on the University of the Republic, the UR

The only public university of Uruguay, the UR, is by far the most important Academic Institution in the country. The UR is a typical product of the Latin American Reform Movement which created a specific type of university in Latin America, with a strong but untypical influence in society (Arocena and Sutz, 2005a). The autonomy of the university was conquered after long fights; the law passed in 1958, the “organic university law”, consecrated as well the co-governance of students, teachers and graduates.

There exist some other tertiary institutes, including four private universities, the oldest of which has only 20 years; their contribution to teaching and research is small but has been increasing.

Tertiary enrollment is around 27%. UR has more than 70 thousands students (above 80% of the total). According to a recent study (Boado, 2005), the joint enrollment of the four private universities is approximately 7.000 students.

Concerning the whole Uruguayan population, some data related with education are quite telling. For example, 80% of unemployed are young people who have not finished Secondary Education. In 1996 - when the last general Population Census took place - less than 9% of those above the age of 24 years had some type of tertiary education, while those who had completed some type of university studies were less than 5% (Boado, 2005).

It can be estimated that in the last decade the UR received on average 14.000 new students each year. An increasing trend is evident: from 1995 to 2005 new enrollment increased approximately 35%.

Concerning the preferences for knowledge areas among the new students, the most striking figure is the low preference for Agrarian studies, 3,5%, the same figure than Arts; Social Sciences and Humanities account for almost 45%, while Science and Technology is chosen by slightly less than 20% and Health (including Psychology) by around 30%.

Graduate studies are a rather new field in the UR, with the exception of the specialization for graduate medical doctors and, since twenty years ago, the exact and natural sciences. Less than 30 persons obtain a Ph.D. type title each year, the majority

of them in basic sciences. Researchers in the UR on a full time equivalent basis are around 1300.

In UR, at an undergraduate level, gender is not really an issue: in recent years women enrollment as well as women graduating doubled those of men. However, the proportion of women in high academic positions is not so even: their participation in a special full-time regime designed to foster research activities is 40%.

An important proportion of UR students work and study at the same time (60%) and 62% come from public high-schools. Almost 6% of UR students receive a small fellowship because of their low socio-economic situation.

Concerning ethnicity, although 6% of the Uruguayan population is of Afro-American descent, their presence in Higher Education is almost non existent.

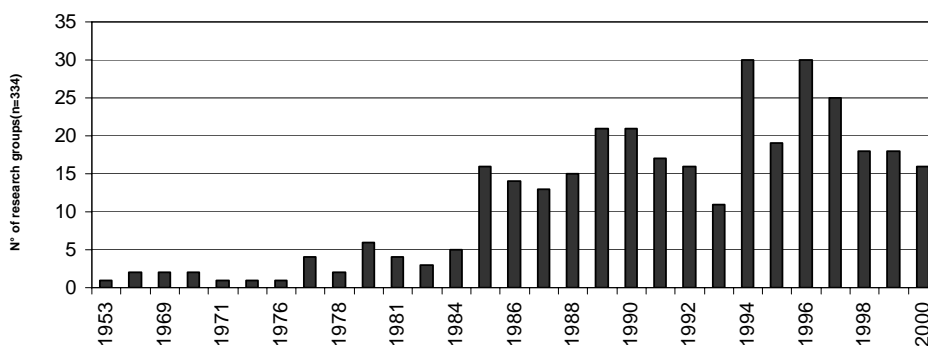
Knowledge generation and training

Uruguay shows a very concentrated structure of knowledge generation and training: more than 60% of all the research made in the country and, as already pointed out, over 80% of higher education, belong to the University of the Republic.

Some main characteristics of the Uruguayan knowledge system have changed significantly in the last twenty years. In 1986 only 13% of all researchers had postgraduate studies and there were no national master or PhD programs (Argenti, Filgueira, Sutz, 1988). Local postgraduate programs began to develop since the late eighties, specially in basic sciences; diverse schemes of fellowships allowed unprecedented levels of people to study abroad. Actually, 80% of all the research groups in UR have at least one member either with a Master or a PhD degree or following postgraduate studies (Unidad Académica de CSIC, 2003).

The following figure shows the evolution of the UR research groups formation in Uruguay; the positive effect of the democratic recovery since 1985 is clearly seen, as well as the early nineties boost, due in part to the massive repatriation of researchers, to a very successful national program to foster the development of basic sciences and to the creation of two new schools at UR: the Faculty of Social Sciences and the Faculty of Exact and Natural Sciences. The decline in the late nineties reflects the heavy economic crisis that affected the country in general and the UR in particular.

Figure 2.- Creation of research groups at UR



Source; Unidad Académica de CSIC, 2003.

Table 3 gives a comparative idea of the Uruguayan R&D situation in the international arena; it includes only small and medium countries:

Table 3.- Some indicators of research in selected countries

	Researchers/million	GERD/GDP	GERD/capita
Argentina 2003	715	0,39	44,0
Bolivia 2002	118	0,28	6,9
Chile 2001	419	0,54	51,9
Colombia 2002	81	0,17	10,5
Uruguay 2002	370	0,26	20,6
Venezuela 2002	222	0,38	20,7
New Zealand 2001	2.593	1,18	246,1
Singapore 2002	4.352	2,19	525,7
Denmark 2003	4.822	2,51	777,6
Sweden 2001	5.171	4,27	1082,5
Finland 2002	7.431	3,46	905,2
Norway 2003	4.442	1,67	612,2
Netherlands 2001	2.826	1,89	536,6
Ireland 2003	2.471	1,14	369,2
Portugal 2003	1.842	0,93	170,2

Source: OECD 2005; RICYT, 2005.

Dominant trends in science and technology demand and use

Uruguay, as seen in the last table, invests a tiny proportion of the wealth it creates in R&D; moreover, more than 80% of these resources come from the public sphere.

Business firms are weak knowledge actors not only due to their low level of investment, but because they absorb few knowledgeable people. From all the researchers in the country only 1% work in business firms, while 80% concentrate in higher education; the proportion of university graduates in the industrial work force is less than 5%. The huge majority of business firms are SME and most of them do not have a single engineer or other scientific or technical trained personnel, a trend that has not changed in the last twenty years.

Table 4.- Proportion of firms without university trained technical staff, 1986 and 2003

1986 innovation survey	> 100 employees	51-100 employees	20-50 employees
% of business firms without engineers	21.9	50.3	73.8
% of business firms without computer analysts or programmers	47.2	66.1	81.9
2003 innovation survey	> 100 employees	20-100 employees	< 20 employees
% of business firms without engineers and other university graduates in science or technology careers	22.5	63.2	87.4

Source: Argenti, Filgueira and Sutz, 1988; Bianchi and Gras, 2005. It must be taken into account that the last survey included the smallest firms, under 20 employees.

This situation reflects and partially explains the weakness of the knowledge demand both from the state and from business firms: very few researchers work there. These leads to a mismatch between the capacities developed by young people and the opportunities they have to apply them to productive endeavors, a worrisome trend leading to brain drain, heavily present in Uruguay.²

University-Government-Industry relations

The relations between UR and the national government have been historically conflictive. These conflicts were usually connected to the university budget, always extremely tight, but they had a more broader political nature. The declining economic situation of the country since the middle sixties, accompanied with social unrest and trade-unions repression, found the UR clearly enrolled in the workers and social movements side. The university was heavily attacked during that time, a process that reached it climax with its military intervention in 1973, that lasted until the end of the dictatorial rule; it was followed by massive faculty firings, as well as exile for many of them. After 1985 the situation changed for the better, but conflictive relations with the new democratic governments persisted. Since 2005, a more cooperative relation is being built; different types of collaboration between the UR and state institutions are expanding quickly.

Even if in general terms the university-productive sectors relationships are not particularly strong, there are important examples of very successful interactions showing excellent results, in almost all fields of knowledge and in several sectors, including bioengineering, wool production, veterinarian vaccines, pharmaceutical products, industrial automation and environment.

From an institutional point of view the UR has put in place many changes to favor stronger and more fluid relationships with production. Formal contractual arrangements between research groups and firms are allowed; researchers can get a plus over their salary for participating in such arrangements; a special commission has been created to deal with problems related with Intellectual Property Rights (IPR) in joint projects with industry; firms can be incubated in faculty laboratories; some faculties have created special offices to encourage and facilitate the links between research teams and business firms. All this shows that what was left from the old academic antagonism towards involvement with business firms has been weakening at institutional level. Changes in ideological perceptions are partly responsible for such evolution; surely part of the explanation also relates to the growing financial difficulties that push research groups towards industry to be able to go on with their work and to keep their most talented researchers.

Summing-up, university-industry relations are stronger than in the past, institutional innovations were put in place to facilitate these relations, researchers are generally willing to participate in research commanded by business firms, the ideological suspicions that these practices used to rise have been eroded and even substituted, in some discourses, by an enthusiastic praise. However, the relations between university and industry continue to be weak: the university change of mood has

² Connections between brain drain and Innovation Systems in the South are discussed in Arocena and Sutz (2006).

not been accompanied up to now by a major productive twist making industry more eager to rely on the university expertise.

4. The Current Debate

Key questions driving public debate on the Higher Education system are related with levels of investment, low salaries, limits to access and payment, relations between public and private institutions, the social use of knowledge and the orientation of the research agendas, the new challenges universities should play in society and how should they be inserted in the National System of Innovation.

Investment, salaries, free access

Educational investment in Uruguay in relation with GDP has been comparatively quite low in recent times. On average, public spending in education has been around 3% of GDP and 0,7% in Higher Education. The new government asserts that it will be increased up to 4,5% of GDP by the year 2009, with more than 1% of GDP dedicated to Higher Education: this has been highly demanded within the leftist political coalition now in power.

Salaries in Higher Education are usually considered low if compared internationally and even regionally; they compete badly with those offered to their technical staff by public enterprises and other public institutions devoted to R&D or technical services. The proportion of the UR budget devoted to salaries, though, is over 80%, leaving little room for key investment like libraries, laboratories renewal or new teaching avenues. This rises many internal tensions between competing demands and is also externally debated: if things are so bad, why not charge for tuitions, why not shift research towards results that some actors may be willing to pay for?

Public education is free of charge in Uruguay, including the tertiary level. This issue has been much discussed. Some years ago the Parliament passed a law that authorizes the UR to establish tuition fees, but the University decided not to do it. Tuition are seen by a majority of university authorities, and particularly by the organizations of students and teachers, as something that harms educational rights and that would diminish the access to higher education, thus weakening the knowledge potential of the country, besides increasing inequality. Those who back tuitions say that they should exist (but be paid only by those who can afford it), to avoid the regressive distributional effect of having the whole population supporting the UR through taxes and at the same time the majority of students belonging to the middle and upper classes. This type of tuition regulation is difficult to implement in Uruguay because the country does not have a tax system based on personal rent, although a project in that direction has recently been approved.

Discussions about merits and flaws of free public Higher Education are connected with international migrations. Should foreign students benefit from such system? Students coming from Chile, where access to Higher Education is neither free nor easy, were accepted for many years in the same terms that Uruguayan students, a norm that is being contested nowadays. Those who disagree remember that many Uruguayans now working in Uruguay – including a large number of researchers – have been able to study without charge in many countries, including Mexico, Venezuela, Brazil, Sweden and others, particularly when they were not able to do it in Uruguay during the military government.

Not less relevant is the “converse problem”, stemming from accelerating brain drain. Many capable graduates and postgraduates trained for free at the University of the Republic migrate, particularly to the US. In some sense, a small and comparatively poor country is subsidizing a very rich and powerful one. Is that a good use for scarce public monies? Addressing the problem does not seem easy.

A “solidarity tax” was established by law, meaning that graduates from UR have to pay an annual fixed tax after five years of graduation, the amount of which is spent in fellowships for students with low income. Preliminary estimations suggest that the system has a quite positive impact. Critics stress that the contribution is almost not related with incomes, that is, graduates hardly earning their living pay as much as professionals with handsome revenues coming for their practice.

In a sense, tuitions yes or not have become a great divide, but not between the left and the right -as it used to be when the left was in the opposition- but between different conceptualizations of higher education and its relations with development. In fact, the left is no more united around this issue. It can be safely said that the forces against any form of privatization of access to public higher education will prevail.

Tuitions are only one aspect of the general debate around free access. In Uruguay, every person who has completed secondary education may enter the university to follow the path of his/her choice: very few careers limit the number of students or have admission exams. Both types of requisites existed when the University of the Republic was governed by authorities appointed by the military government. The elimination of such requisites was an important claim of the democratic opposition, that was immediately implemented when the autonomic governance of the University was restored. They still carry the stigma of having been put in place by the dictatorship.

The university system faces in several cases important problems of mass access; they are particularly acute in the Faculty of Medicine. This has twofold bad results. On the one hand, Uruguay and particularly Montevideo have a high proportion of medical doctors in relation to the population, often only partially employed; on the other hand, the conditions for teaching a large quantity of medical students are far from good. Although the union of medical doctors – *Sindicato Médico del Uruguay* – demands that only a fixed quota of new students should be enrolled each year in the Faculty of Medicine, the students union is strongly against.

The context of many of those problems has been changing with the expansion of private tertiary education, a comparatively new and slowly evolving phenomenon in Uruguay. Nevertheless, important changes are under way; probably the most important one is the opening of the first private Faculty of Medicine. It proposes a six years program of studies, while the title awarded by the public Faculty of Medicine requires not less than eight years and a half. In the long term, comparisons will be telling. The creation of this new Faculty has been hotly discussed and often criticized. Some stress that a more modern and efficient alternative will be healthy for the whole educational system. Others fear that this new paid opportunity will push the public Faculty towards offering “a poor education for poor people”. This debate has been softer, though, than it would have been ten or twenty years ago: the social acceptance of private higher education is much widespread now than then.

The social use of knowledge and the orientation of the research agendas

To put the debate around these issues in context, it must be recalled that the research university in Uruguay suffers from what can be called a “loneliness syndrome” (Arocena and Sutz, 2001): the lack of social demand for endogenously generated

knowledge leaves to a great extent the academic realm on its own. At discourse level voices can be heard claiming for “useful research”, but the real demand of different social actors towards what research the university produces is weak. This is one side of the coin: the other is what researchers perceive as their real duty, that is, the products they have to deliver in exchange for being paid by the taxpayers money. This in turn has to do with the academic reward system, where publishing in international refereed papers is considered the hallmark of academic soundness. This is being challenged now: the debate around the specificities of the academic production in different disciplines and the need to provide diverse ways of measuring quality and productivity is producing changes. The thorny issue of “relevance” continues to be an important part of the discussions, adding a crucial dimension to the debate.

The loneliness syndrome and the current academic reward system shape a sort of schizophrenic situation: research should be useful for different stakeholders that however do not demand its results; according to that, research should be rewarded by its relevance, but the academic system puts a too high prize in results measured in international rather than in national terms.

The debate around these issues has different axes: more emphasis in long term or short term research?; which is the right balance between the academic freedom to pursue knowledge and the duty to be responsive to pressing national problems?; should university research be oriented according to some prioritisation scheme and if yes, at what level should this scheme be elaborated? Inside the UR the debate is vivid but not fierce: nobody denies the key role played by research in basic sciences; nobody denies, either, that the humanities form integral part of what the university is and what it has to offer to society. The debate is more in terms of how to allocate scarce resources to research: some claim that funds should go to fields of knowledge where a direct contribution to national problems can be made, while others claim that the balance in terms of support for all types of knowledge should be maintained.

In a survey among researchers enjoying a very competitive scheme of salary compensation for their full time dedication to the university, conducted in 2006 around what should the priorities be for a National Strategic Plan on Science, Technology and Innovation, some interesting things came out. For instance, the willingness of researchers to devote their efforts to concrete problems of Uruguayan development, even if at the same time they declare that for solutions to be implemented the problems cannot be invented by the researchers themselves but need to be detected and communicated to be able to influence the research agenda. On the other hand, some researchers feared that national priorities could be too much influenced by those with voice and power, for instance the few powerful agrarian sectors with high exports, narrowing the opportunities for addressing the problems of small producers. In more general terms, the main challenge indicated by the researchers to foster the concrete application of research results to problems solving is to better articulate the university to production and society and to better communicate with production and society. This a different wording for what has been already said: the need to understand the work of universities in the wider context of the national system of innovation.

New challenges for the university and insertion in the National System of Innovation

The university system in Uruguay, and particularly the Universidad de la República, face important challenges. Few students enter the system, less than 30%, while the average for the OECD countries is well above 50%; few students come from the countryside, where the university facilities are scarce and incomplete; few students

come from the by now wide part of the population that live in poverty or slightly over it. These are huge challenges that re-define the role of the university today: to become an important actor of social integration in times of the learning economy. The challenge is huge because integration should be pursued among students that exhibit high disparities in terms of knowledge backgrounds and social capital: nothing less than inventing new teaching approaches and mobilizing diverse forms of solidarity within the university will do the job. Part of the challenge is consensual, for instance the need to transform the university in a more inclusive institution. Other parts of the challenge, though, are not so consensual, for instance, the need to have much more university students and university graduates. The latter relates directly to the enhancement of the NSI: only if the actual demand for knowledge grows will the need to strengthen research and to have more university students be widely understood and supported.

Two other challenges related to knowledge production and diffusion are worth mentioning. One relates to foster research on pressing social problems; another relates to the transformation of the historical third mission of the university, extension, into something deeply entrenched with knowledge. This leads to relate knowledge directly with development concerns, to bring knowledge near the people. But this can only have sustainable social impact if it forms part of a wide transformation of the National System of Innovation, where social concerns play an important role.

Finally, a big challenge for the university will be to find ways to foster and participate in a wide national debate on Science, Technology and Innovation policy. This will help building the necessary consensus for a long term knowledge commitment, a must to facilitate the university transformation and to allow the National System of Innovation to become much more integrated and strong.

5. Conclusions: New Development and Developmental Universities

Our major concern is Underdevelopment, a main source of many of the most acute problems in the world of today and the most relevant aspect of inequality. Underdevelopment is a dynamic phenomenon that combines continuity and changes. Some of the most important changes are related with the new role of knowledge in the economic realm and in society at large. Such increasing role of knowledge creates new divides - the “learning divides” - that widen inequality between geographic regions and between social groups. The learning divide between North and South stems from the fact that, generally speaking, underdeveloped countries are weak in advanced *capabilities* - which are mainly obtained by learning at high-level institutions - as well as in *opportunities* for using such capabilities in knowledge-demanding contexts, thus learning by using, solving and interacting.

So in the context of the global but very asymmetric Knowledge Economy, a New Development is needed. For addressing the issue of *capabilities and opportunities*, in such a way that the quality of life is improved, a New Development must include two main aspects:

(A) Socially led innovation and productive upgrading, the expansion of knowledge and innovation capabilities in every productive activity, (including the so called traditional sectors, in order to improve competitiveness), particularly those related to the attention of social needs.

(B) Advancing towards a learning society, based on the generalization of permanent Higher Education, closely connected with the world of work (necessary in particular to “recover” those who have abandoned education).

Both are needed to diminish inequality by expanding individual and collective capabilities so inequality can be further diminished in the future; that is *proactive equality*: equality that generates more equality. (Arocena and Sutz, 2003)

This perspective highlights the role of Higher Education in development processes; it is clearly connected with discussions about the “third role” of universities, and it leads naturally to the notion of developmental university.

The *developmental university* can be briefly defined by commitment to development as its third role. “Now, a more precise characterization can be proposed. [...] the Humboldtian project is not exactly defined by the adoption of research as a second role of universities, but by the joint practice of the fundamental missions of teaching and research. As suggested by [empirical evidence...], performing those missions is essential for the contribution of universities to innovative activities. The conceptual reference is an actors-centered approach to development, directly connected with the Innovation Systems framework. Thus, the developmental university is characterized, in a neo Humboldtian perspective, by the joint practice of three missions: teaching, research and cooperation for development with other institutions and collective actors. That means that developmental universities can only exist as active partners in Innovation Systems.” (Arocena and Sutz, 2005b)

In order to know if this notion can be useful - for research as well as for policy making - several issues must be explored. Some questions related to them are briefly sketched in the sequel.

Possibilities for studying at an advanced level in qualified teaching contexts

- a) how universities co-operate with other organisms to set a wide and diversified system of tertiary education that offers learning possibilities to the majority of the population?
- b) what efforts are being made, at practical and theoretical levels, to cope with the fundamental challenge, posed by life-long education, of offering advanced education to people of different ages and backgrounds?
- c) to what extent tertiary education employs the human and material resources available in the best sites of socially useful production?

Evolution of the Humboldtian project

- a) which are the old and new ways of connecting teaching and research? (because today it is even more true than when the Berlin University was created that such connection is beneficial for both activities);
- b) which are the ways of connecting studying with problem-solving? (a key issue for preparing creative people, able to cope with the quickly changing problems and opportunities raised by the Knowledge Economy).

Academic co-operation with solving social and productive problems

- a) what is the actual participation of academic groups in the solution of specific problems of productive sectors and those derived from the social situation?
- b) what is the priority given to such problems in research agendas?
- c) to what extent and how do universities and related institutions help students and graduates to get acquainted with said problems, and foster their participation in the search of solutions?
- d) in particular, how do they cooperate with external actors in expanding capabilities by means of new opportunities for using advanced knowledge?

The evaluation system

- a) given that the academic reward system is one of the main factors that shape actual research agendas, it deserves special attention in order to gauge priorities and possibilities of academic institutions;
- b) does such system promote a high quality research with a broad scope?
- c) does it foster the attention to relevant cultural and scientific problems, pressing social needs, economic development?
- d) which types of external relations does it promote?

Several issues, including the above mentioned ones, need to be studied in a comparative way in order to assess if the notion of Developmental University is useful, from an empirical point of view - what is really happening today? -, from a prospective point of view - which are the main possible futures? - and from a policy oriented point of view - what should be done?³ As a working conjecture - for which we expect strong corroboration or refutation from the UniDev project - we assume that the notion of Developmental University is useful in relation to the third question, quite probably concerning the second one, and perhaps also for giving partial answers to the first.

³ An electronic article on this topic (Sutz, 2005) was published in paper with the subtitle “Developing countries should promote developmental universities”

References

- Argenti, G., Filgueira, C. and Sutz, J. (1988): *Ciencia y Tecnología: un diagnóstico de oportunidades*, Ediciones de la Banda Oriental, Montevideo.
- Arocena, R. & Sutz, J. (2006): “Brain Drain and Innovation Systems in the South”, *IJMS: International Journal on Multicultural Societies*. 2006, vol.8, no.1, pp. 44-61. www.unesco.org/shs/ijms/vol8/issue1/art3
- --- (2005a): “Latin American Universities: from an original revolution to an uncertain transition”, *Higher Education*, Vol. 50, Number 4, 573-592.
- --- (2005b): “Developmental universities: a look from innovation activities”, paper presented to the GLOBELICS Conference in South Africa.
- --- (2003): “Inequality and innovation as seen from the south”, *Technology in Society*, Vol 25/2, 171 – 182.
- --- (2001): “Changing Knowledge Production and Latin American Universities”, *Research Policy* (30) 8, 1221-1234.
- --- (2000) : “Looking at National Systems of Innovation from the South”, *Industry and Innovation*, Volume 7, Number 1, 55-75.
- Arocena, R. (2003): “La percepción ciudadana de la ciencia, la tecnología y la innovación. El caso de Uruguay”, paper presented to the Workshop on Indicadores of Public Perception: Scientific Culture and Civic Participation, University of Salamanca.
- Bértola, L. & Bittencourt, G. (2005): “Veinte años de democracia sin desarrollo económico”, in Caetano director, 305-329.
- Bianchi, C. and Gras, N. (2005): “Economic Behavior and economic performance in the Uruguayan Manufacturing Industry 2001-2003”, paper accepted for presentation in the Innovation Pressure Conference, to be held in Tampere, Finland, March 2006.
- Boado, M. (2005): “La deserción universitaria en Uruguay: aproximación descriptiva y perspectivas”, Comisión Sectorial de Enseñanza, Universidad de la República, Montevideo.
- Bortagaray, I. (2006): UniDev Project paper: “Universidad de la República: case study”.
- Bulmer-Thomas, V. (1994): *The Economic History of Latin America Since Independence*, Cambridge University Press.
- Caetano, G. director (2005): *20 años de democracia. Uruguay 1985-2005: miradas múltiples*, Taurus, Montevideo.
- Chang, Ha-Joon (2002): *Kicking Away the Ladder. Development Strategy in Historical Perspective*, Anthem Press, London.
- Filgueira, F., Garcé, A., Ramos, C. y Yaffé, J. (2003): “Los dos ciclos del Estado uruguayo en el siglo XX”, en *El Uruguay del siglo XX. La Política*, Ediciones de la Banda Oriental, Montevideo.
- Finch, H. (2005): *La economía política del Uruguay contemporáneo*, Ediciones de la Banda Oriental, Montevideo.
- Hausman, R., Rodríguez-Clare, A. & Rodrik, D. (2004): “Towards a strategy for economic growth in Uruguay”, Interamerican Development Bank.
- Lundvall, B-A. (2007) “Higher Education, Innovation and Economic Development”, Paper presented at the World Bank’s Regional Bank Conference on Development Economics, Beijing.
- OECD (2005) Science, Technology and Industry Scoreboard.
- Pittaluga, L. (coord.): “El Uruguay hacia una estrategia de desarrollo basada en el conocimiento”, in UNDP *Desarrollo Humano en Uruguay 2005*, 149-315.

- RICYT (Red Iberoamericana de Indicadores de Ciencia y Tecnología) (2005): *Principales Indicadores de Ciencia y Tecnología, Iberoamericanos/Interamericanos*, Buenos Aires.
- Schumpeter, J. (1957): Teoría del desenvolvimiento económico, Fondo de Cultura Económica, México.
- Snoeck, M., Sutz, J. and Vigorito, A. (1992): *Tecnología y Transformación. La industria electrónica como punto de apoyo*. Trilce, Montevideo.
- Sutz, J. (2005): “The role of universities in knowledge production”, SciDevNet, Policy Briefs, April 2005
<http://www.scidev.net/dossiers/index.cfm?fuseaction=policybrief&dossier=13&policy=59>. Published also in *Journal of Himalayan Science*, Volume 3, Issue 5, January-June 2005, 53-56.
- Unidad Académica de CSIC (2003): *Grupos de Investigación en la Universidad de la República*, Montevideo.