

Uruguay

(Sources: <http://www.eia.doe.gov/emeu/cabs/uruguay.html>;
<http://www.redhucyt.oas.org/RLQ/uruguay/uruguay.html>; Moyna, P. et al – *Situation of the Chemical Industry in Uruguay*)

National Overview

Uruguay is a highly urban country of about 3.3 million people, nearly half of whom reside in greater Montevideo, Uruguay's capital and largest city. Uruguay ranks among the highest in Latin America in literacy, education, provision of social services, and political cohesion. In November 1999, Jorge Batlle was elected to be Uruguay's new president, and he will take office on March 1, 2000. Batlle is a member of the right-of-center Colorado Party, as is the current president, Julio Maria Sanguinetti. The public sector in Uruguay is unusually large, but the country is moving towards liberalization. Privatization activities in recent years have included concessions for cellular telephone networks, a container terminal at the Port of Montevideo, a major private toll road between Montevideo and the resort town of Punta del Este, and a new \$40-million airport for Punta del Este. A \$1-billion, 22-mile bridge -- the longest of its kind in the world -- between Buenos Aires, Argentina, and Colonia, Uruguay, is under consideration. This would further open up Uruguay as a major trade and transit center between Argentina and Brazil. Uruguay has a strong domestic economy, but its small size and geographic location make it susceptible to economic downturns in its larger neighbors, Brazil and Argentina. Trade with these countries accounts for a large share of the Uruguayan economy. From 1992 to 1998, Uruguay's real gross domestic product (GDP) growth averaged 4.2% per year. However, the devaluation and accompanying economic difficulties in Brazil and the downturn in Argentina negatively impacted Uruguay's GDP growth for 1999, resulting in a 2% contraction in GDP. Growth is predicted to exceed 3% for 2000. Montevideo is establishing itself as an important regional capital. In recent years, a number of multilateral political, economic, and energy organizations and institutions have established their headquarters in Montevideo. Mercosur, the Southern Cone Common Market composed of Brazil, Argentina, Uruguay and Paraguay, is headquartered in Montevideo. The Organization of Mutual Assistance Between Latin American State Oil Companies (ARPEL) and the Regional Electrical Integration Commission (CIER) now reside in Uruguay's capital as well. In addition, the Latin American Integration Association (ALADI) has its headquarters in Montevideo. Most Latin American and Caribbean nations are members of ALADI.

Chemically Related Affairs

US / Uruguayan chemical and related product trade in 1998: US Imports – US\$2 million; US Exports – US\$98 million. There are no chemical or related products US imports represented in the top 20 commodities; Among top US exports perfumery, cosmetics or toilet products; fertilizers; insecticides; polymers of vinyl chloride were represented. The Universidad de la Republica Faculty of Chemistry is the only specialized chemistry teaching institution in the country. It is aimed at the teaching of chemistry, pharmacy, chemical engineering and food science and operates a laboratory dedicated to solid state chemistry. The Chemical and Pharmaceutical Association of Uruguay was founded in 1888 and has approximately 600 members.

Situation of the Chemical Industry in Uruguay

Facing the MERCOSUR

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Introduction.

Uruguay (officially República Oriental del Uruguay) is located in South America, in the center of the MERCOSUR (Southern Common Market), a trading market that comprises Argentina, Brasil, Paraguay and Uruguay. Although Uruguay per se has little over 3 million inhabitants, the resulting market is over 200 million, with a global Internal Gross Product over half a trillion dollars. This new organization opened many new business oportunities to Uruguay-based industries, especially as the 50 million inhabitants with the higher PCI live in a region with less than a 1 500 km radius from Montevideo. Uruguay is ready to become a center for distribution, services and manufacture of products for the MERCOSUR.

The Uruguayan chemical industry.

After many years when the established Uruguayan industrial policy was to have a closed autarquic productive system (1930-1960) , the country in the last twenty years opened to foreign products. The possibility of survival for local industries, with the curtailment of subsidies and other protective measures, was immediately seen lying in the specialization for industrial niches within the MERCOSUR, taking advantage of local possibilities. This industrial reconversion has had different grades of success. Four industrial sectors have shown good reconversion rates and growth. They are the agroindustrial production, process industries for agricultural products, non-ferrous mining and the chemical industry. As it can be observed, they all fall within areas where the chemical aspects are important.

Within the chemical industries, growth has run together with the exports to other MERCOSUR countries, and has covered some basic chemicals and several fine chemical groups. As can be seen in Figure 1., after a period of depression in the exports of products from the chemical industries, the start up of the MERCOSUR has set a clear growth trend.

Figure1.- Exports in chemicals

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The basis for this growth has resided in the proximity of strong and large consumer markets, the Common Market itself, the presence of a reasonable technological base and good training of local chemists, and the availability of other local technical staff.

In particular, the initial small size of the local industries and their specialization to products with reasonable local consumption has resulted in a frame of mind adapted to the production of Fine Chemicals. With an old tradition of certain exports in this field, such as glandular extracts (from the beef industry), wool wax, heparine, essential oils, casein (from the dairy industry), it was possible to extend to other fields. Specialized oils for the tanning industry, pigments, specialized paints and varnishes, certain synthetic products for human and veterinary pharmaceuticals, new lines of veterinary and human medicines, are the lines that have opened the new export trends in the chemical field.

Another aspect that makes this growth feasible is the presence of an improving training for chemists in the country.

Academic support from the Facultad de Química

The Facultad de Química from the University of Montevideo is the only specialized chemistry teaching institution in the country. It is aimed at the teaching of Chemistry, Pharmacy, Chemical Engineering and Food Science Undergraduates, and also for the professional teaching of Pharmacists (Químico Farmacéuticos). Candidates for Food Sciences complete their second University levels, half in the Facultad de Química and half in the Engineering Faculty (Chem. Engineering Inst.). The Chem. Engineering students complete their full second level at the Chem. Engineering Institute of the Engineering Faculty. Over 3/4 of the students in the Facultad de Química are at the undergraduate level and 400 are in the Pharmacy courses.

A more recent development is that of post-graduate students, which began to develop since 1988, when the Magister's, Doctor Chem. and Doctor Pharm. were all modernized. At present over 40 students are completing Mag.Q. degrees and there are over 70 Doctoral Candidates working mainly in Organic, Analytical, Inorganic and Physical Chemistry. At present these candidates are mostly young staff members, but there is a growing interest to attain the degree while contemplating a purely professional career (i.e. in industry).

Figure 2 shows an analysis of the evolution of postdoctoral level Academic staff since the creation of the Facultad de Química in 1929, and Figures 3 and 4 show the evolution of the register of Doctoral candidates and the Doctoral Degrees granted by the Facultad de Química.

The Academic staff includes 180 in the Grades from Full to Assistant Professors.

This better trained staff has been producing a growing percentage of the scientific publications coming from Uruguay, as can be seen in Figure 5.

Figure 2.- Evolution of Staff with Doctoral Degrees

<Picture>

Figure 3.- Register of Doctoral Candidates in the Facultad de Química

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Figure 4.- Doctoral Degrees granted by the Facultad de Química

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Figure 5.- International Publications from Facultad de Química vs all publications from Uruguay (CC*)

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Other advantages of establishing chemical industries in Uruguay to supply the MERCOSUR

1.- A strategic geographical position.

Uruguay enjoys a key position in the MERCOSUR. The capital, Montevideo, has 1.4 mill. inhabitants, is located 200 km from Buenos Aires, 750 from Santa Fe and Rosario, 1000 from Cordoba, 1500 from Mendoza (all in Argentina), 900 from Porto Alegre, 1300 from Florianopolis, 1500 from Curitiba, 2000 from Sao Paulo and 2400 from Rio de Janeiro (all in Brasil) and 1500 km from Asunción (Paraguay). Montevideo is only 1900 km from Santiago de Chile. All these cities are reachable by ground transportation. This description includes almost 80% of all possible consumers of the MERCOSUR.

Uruguay has several good ports (Montevideo, Colonia, Nueva Palmira and La Paloma), is well linked by modern roads to Argentina and Brasil and has a well connected international airport. These basic routes will be enhanced with a direct Buenos Aires-Colonia bridge and the improvements on the Parana-Paraguay waterway, which will connect the Port of Montevideo to Paraguay and even Bolivia.

Uruguay has excellent and modern telecommunications covering all the country, the electricity network covers almost all the territory and 90% of the population has direct access to drinking water. The population is 96% literate and the country has a stable democratic government with a stable and predictable economic policy.

2.- An open and dynamic economic policy

Uruguay has an open international trading, with no restrictions as to international partners, both in imports and exports. This is built on an open and liberal financial system that has been operating in this way for over 20 years. The country has a good standing as for its regular backpayments of debts, and a quite healthy fiscal situation, that has allowed the country to be considered one of the least risky Latin American markets.

These steps, and some structural reorganization that is taking place slowly, has enabled the country to begin lowering its inflation rate, and after a long period of no-growth, towards an annual growth of 3.6%, with a 6% of total re-investment.

3.- A stable regulatory picture.

There is no discrimination against foreign investment, and there is free flow of capitals and utilities. No specific Governmental authorization is needed to open business and there is strict secrecy in the banking system. There are no limits to foreign participation in local industries. Foreign companies can compete openly with national ones for loans and capital, and there is no personal income tax.

There are fiscal incentives for certain industries (forestry, tourism, for example.). There are specific promotions (within GATT guidelines) and a special regime for temporary admissions of products to be re-exported outside the MERCOSUR.

There is a system of free fiscal zones, that has complete exemption of national taxes (except for social security of employees), and where taxes are charged if the products enter the country or the MERCOSUR.

There is a new Investment Promotion Law about to be approved in the Parliament, and there is a new Industrial Promotion Institute in the Government to specifically attend these questions.

4.- Social advantages.

The Uruguayan population has a 96% literacy rate, the highest in Latin America, and is non-religious and compulsory, and the national University, with 60 000 students, provides well trained technical and administration staff. The population is now covered by a dual social security system (national and private), and by an extensive semi-private health system. Population growth is slow, and the life expectancy is around 70 years for men and 75 years for women.

Conclusion.

Uruguay represents a good possibility for establishing fine chemical industries to supply the MERCOSUR region. It has open access to imported raw materials and has a strong production of agricultural raw materials, has good connections to the other countries in the region, which enable a simple and smooth delivery of the products, has well trained personnel available, is fiscally stable and has an open banking system.

AN INNOVATIVE APPROACH TO THE COOPERATION BETWEEN UNIVERSITY AND INDUSTRY IN AN EMERGENT ECONOMY: TECHNOLOGY POLE IN CHEMISTRY AND BIOTECHNOLOGY

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Background

The School of Chemistry (SC), Universidad de la República (UDELAR), is developing a short and medium term strategy directed towards improving the relationships between the University and the Productive Sector. The main objective of this strategy is to facilitate the incorporation of Research and Development (R&D) activities to the industry. In this way, the SC seeks to contribute to enhance the addition of value to national production through the incorporation of knowledge to the production of goods and services, in a way both endogenous and directly managed by the companies.

The strategy is based on the concept that, within the international economic frame in which we live, the addition of value through the incorporation of knowledge to products and services produced in this country, is capital in order to achieve sustainability of economic and employment growths.

Likewise, the relevance of the national productive sector that makes an intensive use of Chemistry can be appreciated, amongst other things, by the fact that it employs 37% of industrial jobs. This supports our initiative of promoting innovation in companies in the chemistry linked sector, including biotechnology.

Both bibliometric data as well as the number of active researchers show that the University has accumulated a significant scientific and technological research capability, in its different Schools and Units, during the past decade, suggesting that this capability could be used appropriately to generate a national demand for knowledge by the Productive Sector, which has not been significant until now.

The SC in particular, has been significantly increasing its scientific and technological research in a continuous manner during the past decade. This can be seen both from the number and impact index of its scientific publications, as from the number of MSc and PhD degrees drawn from research carried out in the SC. In fact, the SC produces 18% of all scientific papers published in Uruguay and indexed in the Institute for Scientific Information (ISI) database, in spite of receiving approximately only 2% of the University budget. Additionally, the SC includes 57% of its staff holding PhD degrees and 6% holding MSc degrees. It also includes 22% of PhD students and 4% MSc students among its junior positions. These figures are relevant considering that 15 years ago there were less than 10% of MSc and PhD holding staff. Moreover, although the first step in this trend was achieved by sending people to do their PhDs abroad, nowadays the great majority of the thesis are done at SC and are actually responsible for the high publishing index of its scientists.

On the other hand, 30% of patent applications carried out by the University proceed from the SC, showing a significant activity in the field.

Broadly speaking, the process of scientific and technological research in the University could be illustrated as follows: a senior researcher supervises a junior researcher (the PhD student) through his or her Thesis work. The PhD student generates knowledge mostly published in worldwide-diffused international papers (only a very small part of it will produce patents). Once the student finishes his/her PhD, if he or she becomes a member of the University staff, will in turn supervise other PhD students, reproducing the cycle and amplifying its effects. Therefore, the major part of the products of public investment in University research which is nationally appropriated are the new scientists produced by this research as the actual knowledge created in the process is mainly going into international public availability.

Today, this closed cycle of scientific and technological research that takes place at the University will, in the short term, lead us to a lack of teaching positions available for the new PhD holding scientists. In this situation (which is already developing in certain areas), the number of prospect graduate students tend to decrease given that the only source of job positions (the University) no longer offers enough employment. The situation tends to worsen associated with the success of postgraduate studies and the scientific research that comes with it as well as the increasing brain drain due to the strong demand of scientists from US and Europe.

If the cycle continues to reproduce, University scientific and technological research itself will lose sustainability given that it basically nourishes, as it does all over the world, from the work of PhD students, numbers of which tend to diminish if no alternative external national demand for graduate researchers exists once the inner-University demand is fulfilled.

In short, if no real demand for researchers on behalf of the non-University Sector exists, the sustainability both of quality research and postgraduate teaching in the University is at risk.

However, if the Productive Sector demands researchers to be incorporated to R&D activities of its companies it will allow both the sustained growth of the economy and the sustainability of scientific and technological research in Uruguay.

Underneath this line of argument lays the fact that graduate researchers remain the main feasible product of University scientific and technological research, to be appropriate nationwide, given that the majority of knowledge that it generates (except for the patentable small portion), are liberated without restrictions for international diffusion, as it is the case for almost the whole bulk of knowledge produced in Universities throughout the world.

The low participation of the Private Sector in financing R&D activities is characteristic of countries in the region (Argentina 15%, Brazil 18%, Chile 30%), as shown in the publication "La Investigación Científica en las Universidades de América Latina. Características y Oportunidades" (Dr. Rafael Guarga, 2000), as compared to middle developed countries such as Spain (48%) and Portugal (41%), or to developed countries such as Canada (56%) and USA (64%). In the latter case, 74.5% of R&D is carried out within private sector, while 10% is carried out by the government and 15.5% by the Universities. While in Chile, only 18% is carried out by the private sector, while government and Universities execute 41% each.

Consistently with this larger participation of the Private Sector in financing and executing R&D activities in the developed countries, the type of R&D in the United States is such that 84% applies to the development of product and services, and only 16% is basic.

These data can be summed up in the following central statement: developed countries have a greater participation of the Private Sector in financing and executing R&D activities due to a significant demand of knowledge by this Sector, while in our countries R&D has been carried out under conditions of very low private demand for knowledge. This low demand is mainly associated to the history of our industrial sector which has been protected during several decades, thus it did not have to compete in the international arena. Furthermore, the industry was used to buy abroad "mature" technology supposed to have a relatively long life and therefore did not host inside the companies any structure not only to create but even to adapt and maintain the imported technology. Both situations changed rapidly in the last decade but the corresponding changes in the industry to develop innovative strategies to cope with these changes as well as in the University to develop new approaches to facilitate these changes in the Industry have not yet developed significantly in the country.

In view of the aforementioned resumed analyses, we propose the University to be strongly committed to facilitate the incorporation of R&D activities in companies, thus becoming a major strategic objective for the University, directed both to achieve better life conditions for the Uruguayans, and to be able to sustain two of its main activities: research and the postgraduate teaching associated with it.

Strategy

To face the mentioned challenge, the SC developed as an strategy the creation of a Technology

Pole to work either as an Incubator for future R&D Departments of interested companies, or as Permanent R&D Partner for others, depending on their needs, sizes and capabilities.

The basic idea is to reach a strategic association between the company and the SC in order to design together a R&D strategy for the company, taking into account on the one hand, the technological needs of the company, and on the other, the possibilities of the corresponding available offer through the University or other scientific actors nationwide or abroad. As this is mainly a problem-oriented research strategy it is necessarily multidisciplinary, thus it is very unlikely that the research needs will be satisfied by a single research lab or institution. Therefore, the need for an associative approach is very clear. Once this strategy is agreed upon, both participants (the company and the SC) share both the implementation of the strategy and its follow-up, as well as the patenting/licensing of the products obtained or the corresponding royalties. Each of these agreements involve sharing risks and opportunities between University and Industry, with no guaranteed benefits for any of them. Once the company decides it is not more necessary to maintain this joint venture with University it may create its own R&D Department or a small R&D company linked to the mother company. But whatever is decided, it is expected that in the long run the company will grow and become more competitive in the international arena and the University will have a new possible customer increasingly demanding for new scientists and knowledge. Therefore this is designed to be a long term win-win strategy.

In this strategic association the SC offers equipment and building facilities, as well as trained research personnel, and the company contributes with technical and professional personnel, as well as the running costs including, when appropriate, scholarships for the PhD students involved in the corresponding research or development activities.

A special funding Subprogramme of the CONICYT-IDB 2 Programme (National Research Council and Interamerican Development Bank), that aims at funding 50% of the salary of a specialist to work in the R&D department of a company, is particularly relevant. Not only it is synergistic with the proposal, but it will also globally facilitate this strategy of R&D incubation in companies, while at the same time promoting the demand of graduate researchers (PhDs) from the University. Other subprogrammes of the CONICYT-IDB 2 Programme will also generate opportunities for the strategy.

Likewise, the CSIC (University Research Council) Subprogrammes for Productive Sector Support are also synergistic with the strategy. They include the shared funding of projects between CSIC and the companies, and a subprogramme for funding of short stays in the companies.

Furthermore, in response to a request from the Technological Bachelor in Chemistry of the Technological University (UTU), the SC offers short stays for students of this Bachelor. And in addition to that, a third level career on Technical Chemistry from the UTU is under study with the support of the SC. Both activities are consistent with the mentioned strategy, and through them the SC will collaborate in training and later supply of qualified technical personnel at the highest level, both for productive and R&D activities.

The SC's strategy is intended to diminish the initial costs of R&D incorporation to companies, and at the same time is sought to generate a long term demand for trained researchers by the companies which need to continue this activity both in or out the University.

Is in this sense that we refer to "incubate" the R&D activities of the company, clearing the way for the generation of a demand of researchers and University-produced knowledge by the Productive Sector to integrate them to the creation of knowledge within the companies, knowledge that will be used in a growing and sustainable manner for the production of goods and services at national level.

Implementation of this strategy is planned to be performed in a gradual manner, starting with those industrial sectors showing an actual interest to associate with this strategy.

At present, two industrial sectors have shown interest to start working with them in the year 2001. They are:

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a) The Pharmaceutical Sector of national production. At present, this Sector demands 44% of all technological services provided by the SC, and it is challenged by the need to generate R&D activities in the short term due to the forecoming enforcement of the Patent Law in November 2001.

The Pharmaceutical Sector has an income around 2% of the GNP, with 60% corresponding to the Uruguayan production sector which manufactures 80% of volume units of medicines consumed in the country. The National Laboratory Association (ALN), which includes all the national pharmaceutical companies, has already adhered to the strategy, and various steps of negotiation with some pharmaceutical companies are already under way to start working in the year 2001.

b) The national Dairy Sector. As an initiative from the Executive Board of CONAPROLE, the major dairy company exporting a significant part of its production, negotiations are under way to direct a joint strategy with the SC towards the incubation of a R&D department for this company. CONAPROLE has been negotiating strategic associations with foreign companies, one of its objective being technological development. Until now, these negotiations have not been globally successful, at least from this latter point of view. This situation has encouraged CONAPROLE to study the possibility of generating its own technology, something quite in accordance with this new proposal from the SC.

Technological Pole in Pando

Such an strategy will be implemented in the Technological Pole, generating working opportunities not only for researchers from the SC, but from other University Units as well as non-University research environments, provided that technological problems necessarily require multidisciplinary solutions. Moreover, the strong international academic relationships build up by Uruguayan researchers might become an asset of great value for the success of this strategy as they allow national companies access to prestigious centres for the generation of knowledge all over the world.

To this purpose, the SC has recently obtained the Technological Lab facilities from ANCAP (National Oil Company) in the city of Pando, with 18,5 acres of surface area comprising a 3.500m² building of lab facilities. The SC will move to Pando all its technological labs, specially those related to the pharmaceutical and food areas, at a first stage.

The activities to be carried out in these premises include R&D, postgraduate teaching in technological areas, and short stays for technological undergraduates. The major undergraduate training in technological areas will continue to be carried out at our main facilities in Montevideo.