Creating Local Innovation Dynamics: The Uruguayan Experience

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The present chapter analyses some of the results of innovation policies implemented in Uruguay since 2007 and their effects on the generation of regional innovation environments and local development. This analysis should be of interest to other Latin American countries where the development of regional systems of innovation is even more relevant because their socioeconomic disparity and environmental heterogeneity are more pronounced than they are in the Uruguayan situation.

Innovation emerges as one of the variables that account for regional economic growth in local and endogenous development models.[1] These processes are characterized by know-how obtained through technological imitation and technological creation, along with significant cooperation and learning.[2] From this perspective, human capital, knowledge, and infrastructure are the most important determinants of regional growth,[3] and public policies are the instruments that activate, mobilize, and catalyse the relations among local stakeholders, which do not occur spontaneously.

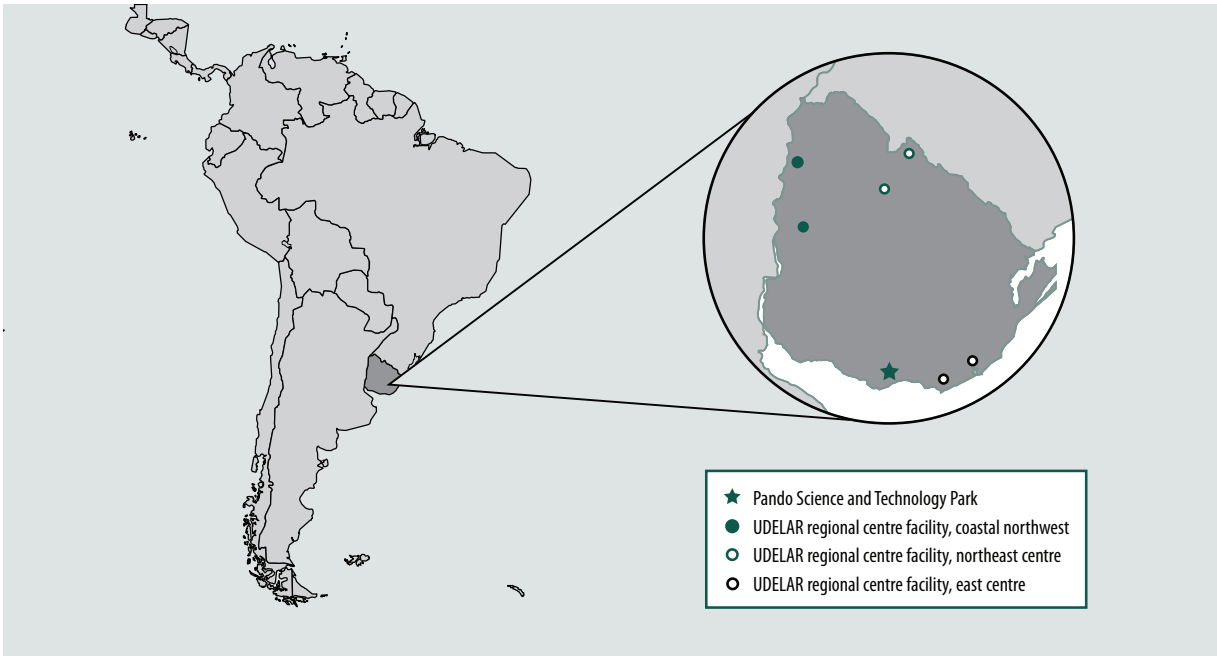
Uruguay has a continental territory of 176.215 square kilometres; in 2012 it had 3.29 million inhabitants and a gross domestic product (GDP) per capita of US$15,300. It leads the rankings, together with Argentina and Chile, of Latin American countries in human development and, together with Venezuela and El Salvador, it exhibits the highest levels of social equality in Latin America.[4] Its literacy rate ties with that of Chile and Cuba, at 98.5%, as the highest in Latin America,[5] and the government offers free education—including graduate and post-graduate studies—to all citizens. It was the first Latin American country to grant free access to the Internet in nearly 100% of the educational public centres by implementing Plan Ceibal, an adaptation of the One Laptop per Child programme created by professors of the Massachusetts Institute of Technology. The country's research & development (R&D) expenditure in 2010 was 0.4% of GDP (equivalent to US$47.4 per inhabitant).[6] The Uruguayan economy has been historically based on cattle production, agriculture, agroindustry, and services in sectors such as tourism, finance, and—more recently—the software industry.

In 2007, for the first time, Uruguay incorporated into its political agenda the systematic development of a national system of innovation in order to promote productive and social development. Under these policies, the Innovation Cabinet was created to lead the system and the National Research and Innovation Agency (ANII) to develop the instruments to be used and administer the resources needed to execute the policies. The results obtained thus far are encouraging: the capacity to generate endogenous knowledge has been strengthened, as demonstrated by the creation of a national researchers system, the funding of access to international scientific publications databases, the creation of a national postgraduate studies scholarship system, and support for new technical careers at the university and tertiary non-university level. Nonetheless, the impact of these policies is analysed from the perspective of local development and innovation dynamics.

Uruguay's approach to regional innovation: The public-sector role

The Universidad de la República (UDELAR) is a public institution that offers a wide range of free career training programmes; it also has the highest number of students, teachers, and researchers in the country (UDELAR employs 77% of the country's researchers). Within the UDELAR system, the majority of career offerings are centralized in the capital city, Montevideo, whereas the system in the rest of the country is characterized by its weak management capabilities and the lack of autonomy to make its own decisions.[7] In 1986, a UDELAR centre in the northern part of the country was established—the first in the process of decentralizing education. In 2007, this process was continued with the creation of three new regional centres (in the coastal northwest, the northeast, and the

Figure 1: Location of the Pando Science and Technology Park and UDELAR regional centres



Note: UDELAR = Universidad de la República.The coastal northwest, northeast, and east regional centres each have two facilities.

east—see Figure 1) with a commitment to provide research, education, and outreach.[8] The development of these centres, with multidisciplinary teaching groups, was based on thematic priority axes that addressed regional demands for education in specific areas such as tourism, agroindustry, and natural resource management.[9]

The process of decentralization, which is still in its development stage, has exhibited some weaknesses in its management and governance. In particular, some tensions have emerged from disciplinary approaches and institutional matters as well as some difficulties regarding the roles to be played and the responsibilities and tasks to be assumed by the teachers.[10]

With the support of ANII, the Universidad del Trabajo of Uruguay—another public educational institution—has increased its technical educational offerings across the country to meet the demands of the productive sector in different regions. For example, tertiary non-university careers are now offered in agro-energy, chemistry, fisheries, informatics, intensive vegetable production, meat technology, mechanics, renewable energies, ship maintenance, and sustainable tourism.

In 2013, the Technological University was created as a public entity with a mandate to bring tertiary education to the regions outside the capital. This university shares the same goals of decentralizing the university system so that the productive sector has sufficient resources available in terms of a skilled workforce and technical capabilities.

Since ANII's launch in 2007, several programmes—such as the National Researchers System and the National System of Scholarships—have been executed to increase the development of human capital and research capacities and direct them to meet the needs of the productive sector by providing sectoral funds, subsidies to support innovation in enterprises, and seed capital for start-ups. These programmes are also intended to satisfy social demands, such as projects of social innovation and support for activities intended to make science and technology part of the national culture. According to information presented by ANII in its annual reports, investment in research and development (R&D) increased between 2004 and 2011—from 0.32% of GDP to 0.41%. The links between research institutions and enterprises are very weak, with only the 35% of research investment coming from the private sector.[11]

The instruments created by ANII to promote links between academia and industry are difficult to execute and expensive to implement because these associations are not generated spontaneously. The National System of Scholarships provides sequential

support to research capacity building that begins with support for graduate MSc and PhD degrees to promote new research. There are a number of instruments intended to provide funding for National Researchers System grant holders. Subsidies are determined by a process of evaluation that categorizes the grant holder at different levels according to training, merit, and scientific production. This system allows access to a monthly stipend contingent on the production of scientific publications and the training of younger researchers, thus allowing the recipient to pursue otherwise non-income-generating research.

Together the linked National System of Scholarships and the National Researchers System promote the formation of advanced human capital, but they have been shown to be ill designed for reaching researchers in the private sector. The professionals working in private companies' R&D departments are barely included in the National Researchers System because of the barriers they face in publishing their own scientific work—personal publication is not always consistent with the interests of employers, who protect innovations made by their employees under confidentiality agreements. On the other hand, the National System of Scholarships requires that the tutors/mentors of the grant holders be members of the National Researchers System, thus almost entirely excluding company professionals from participating in the process of training researchers, despite their practical experience in R&D. This could explain ANII's finding, in its study of applications of the National Researchers System, of low participation rates of companies in the system and in research activities.[12]

Between 2008 and 2011, ANII injected resources into the Uruguayan productive sector by means of 10 horizontal instruments of subsidy, directed to all the companies in the formal sector of the country's economy. An analysis of the ANII reports shows that the subsidies to promote innovation are being given to the most dynamic companies that already have a strong innovative profile. Furthermore, the beneficiaries are centralized in the capital city and have a less significant presence in the interior of the country.[13] The innovation policies are attracting winners that do not need policy support—more evidence of the strong need to advance towards a new generation of instruments that are more innovative and designed to facilitate an increase in the competitiveness, internationalization, and technological adequacy of companies.[14] The observations listed above seem to indicate that current innovation policies may not be aligned with industrial policies, and that more selective interventions need to be developed that promote innovation in sectors and areas identified as priority by the Productive Cabinet (which is coordinated the Ministry of Industry, Energy and Mining, or MIEM).

Since 2007, scientific production (as measured by the number of publications indexed in the Science Citation Index) has increased by almost 50%. However, patent-based indicators—particularly the self-sufficiency rate (patent applications by residents versus total patent applications) and the coefficient of invention (patent applications by residents per 100,000 inhabitants)—decreased between 2010 and 2011.[15] This indicates that the growth of the National Researchers System is not yet reflected in an increase in the generation of value measured by the production of appropriable knowledge. This gap shows the weakness, previously mentioned, in academic-company relationships. It also possibly points out the predominant culture of the researchers, who historically have considered research to be a public good and not an intangible asset with a market value. Further, it shows how little the concept of intellectual property has spread, despite the efforts made over the last several years by MIEM's National Office of Industrial Property.

Instruments created by innovation policies intended to strengthen the interface between academic institutions and companies comprise a valuable contribution that could transform the knowledge generated in universities into economic, social, and/or environmental value, bridging the gap between the offerings of research and the demands of the productive sector. Some initiatives—such as the Network of Intellectual Property—and the process initiated by MIEM with the support of the World Intellectual Property Organization to create Offices of Transference of Research Results point to this objective.[16] Spreading the use of patent databases by science students as a source of technological information is a key measure to enhance their knowledge of the latest technological developments and bring scientists closer to fully understanding the concepts and system of intellectual property.[17]

The barriers that institutions face because of the lack of professionals experienced in technological transference have led even the most developed countries, to continue helping the universities to create greater capacity in intellectual property management. For example, both Denmark and Germany invested several million euros to spur the development of technology

transfer offices clustered around certain regions or in certain sectors, such as biotechnology.[18]

Cimoli, Ferraz, and Primi (2009) state that a well-designed innovation policy alone is not enough if the goal is productive development. There should also be integration between innovation and development policy. The instruments launched by ANII suggest that, in the case of Uruguay, so far this process has not taken place. Neither the applications for competitive funds (where the only requirement was that a researcher presented a project, not that the project had a clear application related to national innovation or the development of the goals of the policies) nor the sectoral funds instruments (which were weakly targeted because too many research priorities were set for very limited resources) seemed to show significant impacts related to the priorities defined by productive policies.

A capacity gap has resulted from asymmetries between central and sub-national authorities. This gap is related to regional weaknesses in terms of innovation strategy design, on one hand, and the limited ability of the central government to identify relevant regional innovation projects without consulting sub-national actors, on the other hand. The decentralization of supporting funds for regional innovation projects that use local knowledge and experience will allow projects that will have a direct impact in local communities to be selected. The country needs to generate high economic value and social impact if it is to significantly accelerate the development of companies and projects in all regions.

So far no instruments have been developed in Uruguay that can decentralize innovation processes, nor have resources and capabilities been transferred to departmental and local governments to lead those processes. In order to overcome the asymmetries, this process must begin by strengthening local management capacities.

Environments of innovation that are linked to local development within the frame of existing industrial policies is the missing link that must now be established to consolidate all previous efforts and give them a chance to succeed.

A practical example: The Pando Science and Technology Park

The Pando Science and Technology Park originated as the result of the coordination, led by UDELAR since 2008, of the development policies implemented by national (ANII and MIEM) and local (the government's Department of Canelones) innovation actors.[19] It is located in an industrial zone, 40 kilometres from the capital, and was supported by Uruguay INNOVA, the European Commission's international cooperation programme, in its foundational stage.[20]

The Department of Canelones is located near the city of Montevideo. The second most populated department in the country, it has more than 520,000 inhabitants. The city of Pando constitutes an important industrial and commercial conglomerate in the Department of Canelones near the metropolitan area. This innovation hub extends from Carrasco International Airport, where a science park (supported by a pharmaceutical group, Mega Pharma, to promote the creation, capture, and development of knowledge- and innovation-based companies) is located near to Pando, 15 kilometres away, where the Pando Science and Technology Park is situated, along with the UDELAR's Technology Pole, School of Chemistry.[21]

This micro-region hosts three industrial parks and numerous companies from the chemical, pharmaceutical, food technology, paper, textile, and cardboard industries. It hosts most of the department's industries, with the chemical industry (including rubber, plastic, and others, which comprise 42% of the industry in the micro-region) and the manufacture of food products (30%) being the main activities. Together these activities account for almost 75% of total local industry. Local industries in the pharmaceutical and medical sector account for a further 4% of the total at the local level.[22]

It is clear that both private and public investment is favourable for the development of an innovation environment. However, public policies are necessary to promote coordination among stakeholders and consolidate a regional innovation system. An assessment made in 2008,[23] before the creation of the Science and Technology Park, showed that the Technology Pole of the School of Chemistry (UDELAR) had poor relationships with the community in the region even though it was a fairly new project—it had been created within the past decade. This confirms the notion that interaction among stakeholders is a decisive factor in the development of regional innovation systems, but interaction does not appear spontaneously and must be generated through appropriate instruments. In order to organize a process of this kind, it is necessary to have skilled professionals who are prepared to manage local development, the governance of the process, the communication with stakeholders, and the coordination of projects.[24]

Following the creation of the Pando Science and Technology Park, the links between the R&D generators from the university and the business sector have been strengthened, thus promoting local development. This model is driven and guided by the governance of the park, where the university, the Chamber of Industries, the Ministry of Industry, and the Department of Canelones Uruguay are in partnership.

Although the Pando Science and Technology Park was established by law, a mechanism to encourage businesses to participate in this ecosystem and instruments to promote academia-business links or intellectual property were not defined. It was expected that the park would generate resources from its intervention in the market by selling services to companies. However, the experience of countries such as Spain, which has developed several science and technology parks, shows that these organizations reach a break-even point in the medium to long term (8 to 10 years), before which they require public support.

Comparing Uruguay's experience with that of other regions

Nieto (2010) analysed the experience of the Basque region of Spain and highlighted the importance of the design and implementation of active public policies that promote the generation and use of knowledge to systematically increase the competitiveness of production.

Despite the constraints mentioned earlier, interactions between the services of technology platforms from UDELAR's School of Chemistry and the private sector have increased significantly in the last year. The Pando Science and Technology Park has provided the technology centre with a professional innovation management system, which allows it to focus on R&D processes.

The innovation policies did not coordinate with UDELAR's efforts in creating regional centres in the interior of the country. To generate the necessary synergies, the interventions must promote communication among academic institutions, enterprises, and government. They must simultaneously promote the professionalization of management, focusing the installed capacities on the priorities established by the national and departmental governments, for local development.

The above weaknesses can be found in most Latin American countries. A case in point is a study by the Economic Commission for Latin American and the Caribbean,[25] which brings together standardized data on 53 clusters located in 19 states in Brazil, one cluster in Colombia, and one in Peru. Among its findings, it identifies problems of coordination among agents and highlights the formation of networks and consortia as drivers of these mechanisms. The education and science and technology sectors are cornerstones in the process of building industrial competitiveness, although the evidence indicates that the mere existence of knowledge does not guarantee innovation—to foster innovation, knowledge should be integrated into development policies.

In the case of Chile, for example, Von Baer (2009) analyses regional innovation systems and concludes that, regarding regional productive development and/or innovation agendas for competitiveness, no explicit mention has been made of the mechanisms for linking the areas of productive development and innovation. He proposes addressing both processes together by constructing spaces for interaction and communication, and for strengthening the relationship between academia and businesses. In 2012, the Corporation of Promotion of the Production of Chile developed a pilot program to decentralize the instruments of innovation by transferring the resources to three regions and, if it is successful, plans to replicate it in throughout the country.[26]

Some policy and strategic implications for local innovation strategies

From the experience of managing local innovation clusters, the following considerations can be empirically extracted:

- Environments of regional innovation need public policies to support them during the initial stages when they are getting established, thus generating structures of governance linking the academy, companies, and governments.
- Selective interventions for the promotion of these structures are needed because the enterprise-academy-government relationships are not generated spontaneously.
- The local governments must be firmly involved in the centres and in the construction of their agendas.
- The area where policies are developed must be separated from the area where they are executed (politicians are not necessarily good managers).
- The management of the centres must be carried out by professional management personnel in professional management structures. The managers must be trained in business administration (not in research or

teaching—professors are not necessarily good managers).

- A systemic approach must be promoted from the political environment to improve communication among all the associates. The quality policies, the information systems, and sharing strategic plans among the actors are some of the instruments that can be employed to achieve this goal.
- Mechanisms to evaluate the impacts of the centres and a clear commitment with management that defines short-, medium-, and long-term goals in accordance with the goals of the regional and national governments must be established. Public support for these environments must be directly tied to the fulfilment of the above-mentioned commitments.
- The innovation environments must generate ties with local companies in general and with the social local actors where the centre is located.
- The regional centres of innovation are dynamic structures where the generation of ties with other actors of the national innovation system must be promoted.
- The creation of public-private alliances must be encouraged.
- Strategic leadership at the regional and local levels is necessary.

This chapter has presented evidence that innovation policies have to focus on social and productive priorities defined at the national level by industrial development policies and at the regional level according to the productive specificities and socioeconomic particularities of each regional unit. In this context, it is particularly important to generate innovation environments. It is also essential that the government become involved as a catalyst for interaction among stakeholders, particularly in regard to the mechanisms that lead to a closer relationship between academia and businesses, the promotion of the best intellectual property management practices at universities and technical institutes, and actions that promote an increase in the number of patents.

Instead of focusing on finding or establishing a leader of collaborative networks, the idea of shared leadership becomes the primary focus. In this context, leadership is the ability to be a 'process catalyst' and the emphasis is on building trust and new ways of working together.[27] Hence the challenge of all stakeholders is to coordinate and lead to align actions, programs, instruments with the objectives of the national innovation and development policies.

Notes

1 Ogawa, 2000; Love and Stephen, 2001; Cheshire and Malecki, 2003.

2 Bramanti and Maggioni, 1997; Maillat, 1998.

3 McCann and Shefer, 2003.

4 CEPAL, 2012.

5 CEPAL, 2012.

6 ANII, 2011.

7 De la Cuesta and Heinzen, 2012.

8 Arocena, 2009.

9 UDELAR, 2008.

10 De la Cuesta and Heinzen, 2012.

11 ANII, 2011.

12 ANII, 2011.

13 ANII, 2011.

14 ANII, 2011.

15 ANII, 2011.

16 For details about the Network of Intellectual Property, see www.redpi.uy.

17 WIPO, 2007.

18 Cervantes, 2013.

19 For further detail about the Pando Science and Technology Park, see www.pctp.org.uy.

20 For more information about Uruguay INNOVA, see http://eeas.europa.eu/delegations/uruguay/projects/list_of_projects/19040_en.htm.

21 For details about UDELAR's Technology Pole, School of Chemistry, see www.polotecnologico.fq.edu.uy.

22 Barrenechea, Rodriguez, and Troncoso, 2008.

23 Barrenechea, Rodriguez, and Troncoso, 2008.

24 Garofoli, 2009.

25 Teixeira and Ferraro, 2009.

26 For more information about decentralizing the instruments of innovation, see http://www.pmgdescentralizacion.gov.cl/.

27 Mandell and Keast, 2009.

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