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The Public Institutions of Science and Technology as Knowledge Source in the Learning Networks of Agri-food Sectors in Argentina

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Abstract

In the case of agri-food productions, Argentinean enterprises—mainly medium- and small-sized, have a critical neck bottle that limits their possibility to build endogenous capabilities for knowledge production, circulation and appropriation. As a consequence, public institutions of science and technology have been called to play a central role in the innovation systems providing relevant inputs for the necessary learning process in order to obtain product and process innovation. Nevertheless, it looks like that these institutions, in Argentina, are prisoners of the offer (science) push—demand pull tension far away of a systemic behavior in an innovative environment. This work studies four cases of agri-food production in Argentina, considering a regional approach and the learning networks around each production. It is concluded that the behavior of each institution is different for each case. INTA has a systemic conduct in all cases while the other ones show a systemic behavior only in the case that their offer matches to specific demands.

Keywords

Innovation system, winery, dairy, olive, rice

The aim of this work is to explore the role played in Argentina by the public institutions of science and technology (S&T) as the source of knowledge in the agri-food industry innovation. The question to be answered is in which measures public institutions of S&T are engaged with a systemic behavior or they are the prisoner of a demand pull—offer push scheme.

In the next section the studied situation is described following by some characteristics of the National System of Science and Technology in Argentina. In the fourth section the theoretical framework is pointed out. Then the empiric evidence is presented. The work ends with some final considerations.

INNOVATION IN THE ARGENTINEAN AGRI-FOOD INDUSTRY

In Argentina, the agroindustrial activity represents the 18.5% in the GDP. Through direct and indirect employment, it explains the 35.6% of total employment of the country (Anllo, Bisang, and

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Salvatierra 2010; Nogues and Porto 2007). The revenues arising from this activity are equivalent to the 12.3% of GDP that means the 40% of the tax income (Nogues and Porto 2007). The 33% of the added value of the activity is traded in foreign markets while the 67% of it is in the domestic one (Nogues and Porto 2007).

In terms of Argentinean exports, the agroindustrial activity represents about the 50% while the food and beverage industry[1] contributes with the 95% of that and the 46% of industrial exports of the country (Anllo et al. 2010; Nogues and Porto 2007).

In an aggregated point of view, the innovation process in the agri-food industry follows the Pavitt's taxonomy (1984) being supplier driven. Thus, in this industry the innovation depends on innovation in other industries (chemical, biotechnology, metal mechanics, etc.), suppliers of additives and ingredients and devices.

This situation requires close relationships between process, product and logistic technologies. Product innovation is the incremental type pointing the competition through a diversified offer (non-price competence). As a result, product innovation is both supplier driven and product differentiation pulled by the distribution (Bisang and Gutman 2005).

In practice there are other factors acting as constrainers of the innovation process. Some of those factors are intrinsic of the agri-food industry in general, and other ones are proper of the agri-food industry in Argentina.

Within the first ones there are the biological characters of the production and the human consumption as its final destine. These characteristics, on the one hand, impact as a longer production process fixing capitals for more time than in other productions with the addition of an economic risk by the occurrence of climatic phenomena. On the other hand, the production must accomplish severe regulations in order to prevent chemical, physical and microbiological contaminants (food safety) and to assure a particular nutritional standard (Bisang and Gutman 2005).

The more critical constrain to the innovation process in the agri-food industry in Argentina is, probably, its heterogeneity expressed in many different ways (organization, technological dynamics, source of capital, size, etc.). Regarding the technological dynamics, in this industry it is possible to find some productive sub-systems working close to the technological frontier addressed to exports. Other ones (less dynamic) are oriented to the domestic market through product differentiation and other ones oriented to massive consumption of products with any differentiation (Ghezan, Mateos, and Elverdin 2001; Gutman and Lavarello 2002).

At the same time there are regional subsystems, very laggard, with subsistence production or mainly of local consumption with poor or any national projection.

Regarding size and source of capital, the universe of Argentinean enterprises of the agri-food productions is mainly small- and medium-sized of local origin. Bigger companies are of transnational origin, only few in that segment are of national origin (Gutman and Lavarello 2002).

In the described context only a small part of the enterprises are in condition to act as the source of their knowledge through own research and development (R&D) departments. They are the bigger ones that are on the top of the technological dynamics as it was previously described. The other ones need an external source of knowledge. As the technological dynamic is going down, the source of knowledge goes from a mix of their own experience, suppliers, competitors and public institution of S&T until a mix of just their own experience and public institution of S&T. It means that innovation in these industries depend critically on public institutions of S&T.

Then, it is possible to conclude that the innovation process in the Argentinean agri-food industry is strongly dependent on the public institutions of S&T as the source of knowledge.

PUBLIC SCIENCE AND TECHNOLOGY IN ARGENTINA

During the 1950s the four mean institutions devoted to Science and Technology (S&T) were founded: in 1950 the National Commission for Atomic Energy—CNEA[2], in 1956 the National Institute of Agricultural Technology—INTA[3], in 1957 the National Institute of Industrial Technology—INTI[4] and in 1958 the National Council for Scientific and Techniques Research—CONICET[5]. These institutions completed the body of public S&T with the Universities that started during the 19th century. Since that until these days, the body of S&T has evolved being its actual composition difficulty of enumerate completely. To the mentioned institutions, of national scope, others ones were summed in time with a wide diversity of concerns and geographic scope due to the diversity of districts that pursuited the incorporation of S&T to their policies.

According to indicators published by the National Statistic System on Science and Technology for the year of 2008, the public S&T accounted for 50 thousand people between researchers and postgraduate students (scholarship). From this, 84% were in the public sector, 8% in the private one and the 8% in private universities. For the same year, the expenditure in R&D reached the 0.52% of the GDP while in scientific and technological activities—as defined by UNESCO, it reached 0.61% of the GDP. In both cases 70% of the effort corresponded to the public sector and the remaining 30% to the private one (MinCyT 2008a).

This is an indicator of that R&D in enterprises is an activity carried out only by transnational firms and by a short number of big national firms or groups operating in the country. However, transnational firms have their R&D labs in their central houses located, in general, in developed countries. Developments in such labs are shared with the local subsidiaries protected through patents and other tools of intellectual property protection. In this way such capabilities are out of the national frontier having a scarce (or neither) impact on the building of national endogenous capabilities. The big core of the local industries is composed by small- and medium-sized enterprises without capacity to generate their own R&D being, thus, necessary to be supported by public capabilities of R&D.

The National Agency of Science and Technology Promotion[6]—ANPCYT, depending on the National Ministry of Science, Technology and Productive Innovation, is the most important public institution devoted to funding scientific and technological activities. This agency provides financial support through the Argetinean Technological Fund —FONTAR, the National Fund for Science and Technology Research—FONCYT and the Argenitnean Sectoral Fund—FONARSEC. FONTAR provides support to project addressed to enterprises to improve their productivities by technological innovation, FONCYT is addressed to S&T teams for research projects while FONARSEC is addressed to build up capabilities in critical areas of high impacts for permanent technology transfer to the productive sector. The resources for these funds are provided by the National State through external credit from the Inter-American Development Bank (IDB) and the International Bank of Reconstruction and Development (IBRD). According to data published by the Ministry of Science, Technology and Productive Innovation in the period of 2003-2008, FONTAR has granted innovative project[7] to enterprises of the Argentinean agri-food sector by, approximately, US$27 millions[8]. In the period of 2004-2007, FONCYT has granted research project linked to the Argentinean agri-food sector by, approximately, US$15 millions[9] (MinCyT 2008b). During the year of 2011, FONARSEC has granted four projects to public-private agreements between public institutions of S&T and one or more enterprises from the Argentinean agri-food sector, by an approximated total of US$5.1 millions[10].

Econometric studies have demonstrated the positive impact on the innovative behavior of enterprises receiving subsidies from FONTAR and on the scientific productivity of researchers receiving grants from FONCYT (Chudnovsky et al. 2006; Lopez, Reynoso, and Rossi 2010).

From its own part, INTA has a portfolio including basic, applied, adaptive research and social intervention projects. Thus, from its own budget, in the period of 2009-2011, INTA has managed research and social intervention projects by approximately US$32 millions[11] per year (INTA 2011). This portfolio is addressed to farm, agroindustrial and agri-food productions.

By these days there are two current relevant issues in the public agenda regarding policy in S&T. One of them is to find out a high level of coordination between the several S&T institutions in order to achieve a real systemic behavior in the institutional body. It is pointed out by scholars on S&T policy that, in Argentina, the S&T constitutes a complex rather than a system due to the poor (or inexistent) coordination in the actions of the several components. The other relevant issue is to match S&T priorities to those of production in order to incorporate knowledge as a strategic input in productive processes. In the current situation a tension demand-pull/offer-push is observed in the harmonization between S&T priorities and production requirements. This dichotomy leaves far away a desirable systemic behavior in order to achieve effective knowledge based on a productive system.

THE THEORETICAL FRAMEWORK

It is possible to understand the relevance of the problem pointed out previously by applying some methodological tools built with contributions from the evolutionary theory and the sociology.

Innovation is recognized as an uncertain, long-term and extremely path dependence process that it makes enterprises unable to be innovative isolated in every direction (Schumpeter 1976). As a consequence it means that it is required a rich innovative environment supporting the learning processes for those enterprises. Such innovative environment can be understood as the innovation system which is conceptualized as a set of relationships established in the innovative context to carry out learning processes[12].

The evolutionary economic theory considers the economic development as a process that involves the co-evolution of technologies—known and in use, and the institutions supporting and regulating them. From the innovation system point of view, the term "institution" encloses two overlapped ideas. On the one hand, the complexity of many market relationships embedded in broader social and institutional structures, and the elements of cooperation and trust. On the other hand, the role of non-market institutions, like university and public research systems, scientific and technical societies, and government programs, is in the innovation process in many sectors[13] (Nelson 2007a).

Focusing now on the involved social issues it is possible to cite the social technologies' definition of Nelson and Sampat (2001; as cited in Nelson 2007b) and the socio-technical approach of Thomas Hughes (1987; as cited in Brieva 2006).

Nelson and Sampat defined the concept of social technologies differentiating technical steps, e.g., steps in a receipt—physical technologies, in the way those steps were applied to social technology. For example, industrial R&D can be viewed as a combination of a set of physical technologies—e.g., lab procedure, and social technologies—e.g., a division of labour among scientists and various structures of coordination and direction. According to this approach the focus is on the prevalent social technology being eclectic about what the institution is. In this way the institution can be a lot of things that support social technologies and, also, constrain them (Nelson 2007b).

From the socio-technical point of view, technological, sociological, economic and scientific aspects of the technological change cannot be distinguished. Technological systems can be defined by their objectives—e.g., to solve problems, and by their components—complex, diverse and heterogeneous, coordinated in terms of problem-solution. According to Hughes, the components of a system can be physical artefacts, organizations—e.g., enterprises, banks, etc., scientific elements—e.g., books, articles, teaching and research programs, etc., laws, regulations, patents, etc. Through their interactions, those components contribute to reach the objective of system and due to those interactions the actions of any of the component impact on that of the other ones. Also if one of the components is changed or modified, the performance of the system is also affected (Brieva 2006). In this way, similarly as it was indicated by Nelson (2007a), a co-evolution of the entire system exists.

Thus, from the expressed concepts, the learning process carried out into an innovation system could be reduced to a set of actors interacting in a network (Harty 2010). What is such network? Who are the involved actors? What are the connections between them? The answers to these questions can be found by applying the Actor-Network Theory (ANT) by Bruno Latour (2005). Following in this line it can be considered that learning processes result from the interaction between the components of the innovation system. It is possible to rename those components as "actors"—being human or not. In this way, the ANT is a useful tool able to track the relationships between them (Latour 2005).

The Functional Model of Innovation System (FMIS) proposed by Kadura, Langbein and Wilde (2011) integrates the previous concepts. With a holistic vision, FMIS identifies actors at three levels—micro, meso and macro where they act as mediators or as intermediary establishing (or bridging) a set of relationships.

EMPIRIC EVIDENCE

The empiric evidence was recorded in a recent study at sector/regional level of innovation system associated to food production in Argentina (Sanchez 2010; Sanchez and Bisang 2011). They were four cases from which the remarkable issues were as follows.

Wine Production in the Mendoza Province

The wine production has had several transformations in time following market changes. However the most important changes were during the 1990s when stainless steel machinery and refrigeration were introduced. Since 2004 the national state promoted the strategic planning for the sector through the Law 25.849 creating the Argentinean Corporation of Viticulture, COVIAR, as the executor of a strategic plan of 2005-2020. The Corporation is a public-private entity, understood as a tool of management sustained by the common good. The mentioned law established the actors of COVIAR. They are government institutions (national, provincial, local), chambers, associations, regulating institutions and INTA (COVIAR 2004) which is the unique-called S&T institution.

The first step in the planning process was the plan development coordinated by INTA in a participative process. In this part of the work universities and social organizations, not included in the law, were invited to participate by INTA. During this step stronghold, weakness, opportunities and threat were identified, from which objectives, strategies and actions were defined through consensus. The most important weakness found was associated to R&D activities (Ruiz and Vitale 2011). The actions were decided to be oriented to markets—domestic and foreign, inclusion of small grape producers and built endogenous capabilities on R&D. Nevertheless, the plan could not identify with a specific name which is the institution, excluding INTA, and would be called

to work in this issue.

As a second step, it could be considered as the period of execution of the plan until these days. It was interesting to note that all the actions, in general terms, were initiated with the exception of that defined to solve weakness in R&D. In this case it is observed the participation of universities in the execution of projects but INTA is still the unique institution of S&T that is present in this system, even though other institutions—e.g., INTI and CONICET, are present in the region and have research lines in topic able to be applied to the wine production.

From the collected evidence it is clear that INTA plays a role of leader and coordinator in this production and it is recognized thus for both industry and producer. Also INTA is recognized for its scientific and technical capability for producer and industry and by local and transnational suppliers. This situation is reflected through agreements and projects carried as a joint venture for specific purposes.

Dairy Production at the Central Basin of Santa Fe Province

The dairy production at the central basin of Santa Fe province includes medium- and small-sized industry of national origin. The production is mainly addressed to domestic market through differentiated products in some cases, and with any differentiation in other ones. Only milk powder is addressed to foreign market but suffers impact of crises abroad and local macro-economic and trade policies. Regarding primary producer they are also medium- and small-sized.

The knowledge, in this case, flows by three avenues following the type of production.

One of those avenues is the farm production of milk (raw material). In this case the source of knowledge is INTA almost exclusively. The relationship between feed, quality of product and sanitary handling is the main issue.

The second avenue is for the knowledge regarding cheese production by medium, small and family producers. In this case the sources of knowledge are, in first place INTA and INTI. INTA has a pilot plant for cheese production of up to 200 L while INTI has one 2,000 L of capacity. The agreement between CONICET and the National University of Litoral (UNL) created the National Institute of Industrial Lactology (INLAIN). The INLAIN through its industry area is the source of knowledge addressed to sheep cheese of very small producers in the north and centre of Santa Fe province.

The third avenue corresponds to differentiated products—functional milk products. This kind of product requires the development of micro-organism which is added to the product during the production. The development of such micro-organism requires to have some specific facilities in addition to the pertinent knowledge to do it. There are public research centres specialized in such area. One of them is the already mentioned INALIN through its micro-biology area. The other one is the Reference Centre for Lactobacillus (CERELA), with shared dependence between the CONICET and UNT, located in the city of San Miguel de Tucumán, province of Tucumán, far way from the geographic area we are considering (centre of the Santa Fe province).

The Introduction of Non-transgenic Rice Seed Resistant to Herbicides of the Imidazolinones Group in Entre Rios Province

The rice case has two remarkable sides. In first place the character of a non-transgenic seed resistant to herbicides makes the product friendly to the environment as an alternative to Genetic Modifed Organisms (GMOs). The seed was obtained by INTA by traditional tools of genetic improvement. The variety was registered by INTA as Puitá-INTA CL and it was a seed resistant to herbicides of the imidazolinones of high level of production, high quality and adaptation to tropical and subtropical climates. INTA licenses the global trade to BASF & Co. as a part of the Clearfield package. The second

side to be remarked is this seed as a tool to recover for production unproductive areas infested with red rice, an uncontrollable weed of similar characteristics to rice.

Even though rice production is exported as a commodity, rice seed is included as technological package traded by a transnational firm paying royalties to a public institution of S&T.

In the case of rice production at the Entre Rios province, whole value chain was sensible of problems of red rice and that of quality associated with foreign market requirements. INTA is an institution presented in the region and involved in the production problem solutions since long time ago. So the development of the new variety was natural and rapidly adopted by local producers. Also INTA was one of the founders of PROARROZ Foundation nucleating actors as of the whole value chain as from public sector. The activities of PROARROZ are sustained by the contribution of producers and industry as it is established by the Entre Rios Law 9228 of development of rice production at Entre Ríos. Except INTA and Universities there is no other institution of S&T presented in the region.

Traditional Olive Production in Aimogasta, La Rioja Province

The traditional olive production in Aimogasta, La Rioja is problematic arising from national laws for economic development promoting the inversion in agroindustrial activities differing tax payment. The aim of this policy is to promote the technological change in this particular case of the olive oil industry, in order to improve the global competitiveness of enterprises. As consequences of this policy, big areas in Catamarca and La Rioja provinces were reconverted changing varieties, adjusting handling method and sanitary controls and installing capacities for olive oil production according to international standards. This new way to produce is known as modern production.

Simultaneously, there is a big number of small producers not able to be reconverted. They are still producing the native variety *arauco* as table olive—mainly addressed to local market, far away from the optimum technological conditions regarding as productivity as environmental care. This is the traditional olive production, technologically far behind modern production. The producers' family income is mainly from public employment while the olive production is a complementary income. The reconversion is not possible due to several factors: land property, nearness to built-up area, between others. Therefore it is necessary for some actions in order to ensure the social existence of those producers. In this case the bottle neck is due to associability aversion and ignorance of transformation process environmental friendly of the producers. In this case, technological tools are known and available publicly.

The intervention in this case is carried out by a local agency of INTA at Aimogasta in collaboration with local and province government. The action, in this case, promotes association of producers and provids technical support to producers for both olive production and transformation in table olive.

INTA is recognized for traditional producers as the nucleating actor as consequence of its historical path in the region, which is shared by government agencies. In addition, INTA is the unique institution of S&T, presented in the region, concerned by the problematics. Other institutions, also presented in the olive production region, are focused on the modern production because of its economic importance regarding regional development.

FINAL CONSIDERATIONS

The evidence described in a stylized way how the public institution of S&T participated in the innovation system of agri-food production at regional level for the studied cases. Such description can also be interpreted as the description of the micro-level of FMIS according to Kadura et al. (2011).

Agri-food production is in the group of natural resources exploitation activities and in this way it can be considered as a low dynamic activity. However, despite of this, some windows are opened in order to see them as a tool for development (Pérez 2010) or as a tool to improve the welfare of the society. This issue should be the most important guide for the public management of S&T in the cases of natural resources based on economies.

In the presented cases, the technological dynamic can be compared through the type of the traded product and the market addressed for such product.

In this way, the winery industry in Mendoza province is focused on a product mainly addressed to foreign market with high quality standard. The dairy industry at the central basin of Santa Fe province is focused on the domestic market with the exception of milk powder. This production is diversified in the domestic market where co-exists massive products without differentiation, functional products—highly differentiated and small production of sheep cheese focused on the local market.

In the rice case there are two sides from which the analysis can be done. On the one side, rice production is traded as commodity without differentiation following quality standard established by consumer. The other side to be considered is a biotechnological product developed by INTA and global traded by a transnational company.

Finally, olive traditional production at Aimogasta, La Rioja is not conditioned by the type of the product. The type of production and its social and environmental impact are the bottle neck to be solved.

Each of the presented cases is able to be analyzed as a network associated to the correspondent innovation system where the knowledge flows to give place to learning processes with different objectives. The participating actors of each network were briefly described in the previous section.

INTA by its own scope is the public institution of S&T involved in all the agri-food production, being able to cover both activities of social character and scientific and technological activities. The participation of other institutions of S&T is conditioned by the technological dynamic as it was described previously.

In the case of the winery industry, the source of knowledge is basically INTA and suppliers of additives and ingredients. In this case even though other institutions of S&T, like CONICET and INTI, are presented in the productive region they do not participate in the network. The network is integrated by actors from production, industry, government and social organization being of high density with this kind of actors. The opposite situation is found in the dairy production at the central basin of Santa Fe province where the network has a high participation of public institutions of S&T, and all these institutions presented in the region play some roles in this network (Sanchez and Bisang 2011).

In the case of the rice production at the Entre Rios province, INTA is the unique S&T institution considered by producers and industry as the exclusive source of knowledge.

The case of traditional olive production at Aimogosta, La Rioja has the particularity of social intervention more than of technological one.

The cases of the winery production at Mendoza province and the dairy production at the central basin of Santa Fe province are clear examples of a tension offer (or science) push—demand pull. Where offer and demand match, the public institutions of S&T have active participation in the learning network associated to specifics productions. The rice production at the Entre Ríos province and the traditional olive production at Aimogasta, La Rioja province could be taken as examples of systemic behaviors.

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Notes

1. Chapter 15, CIIU, revision 4 United Nations and National Economic Activities Classifier 2010 (ClaNAE 2010).
2. *Comisión Nacional de Energía Atómica*, the Spanish name. Support of science and technology to policies in matter of nuclear energy for the peace. Retrieved from http://www.cnea.gov.ar.
3. *Instituto Nacional de Tecnología Agropecuaria*, the Spanish name. Support of science and technology for agriculture and animal production. Retrieved from http://www.inta.gov.ar/.
4. *Instituto Nacional de Tecnología Industrial*, the Spanish name. Support of science and technology to the manufacturing industry. Retrieved from http://www.inti.gov.ar.
5. *Consejo Nacional de Investigaciones Científicas y Técnicas*, the Spanish name. It is the main government organization devoted to the promotion science and technology in Argentina. Its activities involve four knowledge areas: agriculture, engineering and materials, biologic and health sciences, exacts and natural sciences and social and humanistic sciences. Retrieved from http://www.conicet.gov.ar/.
6. Retrieved from http://www.agencia.gov.ar.
7. As subsidies, tax credit and soft credit.
8. Using an average exchange rate, for the period, of 3.022 local currency per United State Dollar as reported by the Central Bank of Argentine Republic. Retrieved from http://www.bcra.gov.ar/estadis/es030102.asp.
9. Using an average exchange rate, for the period, of 3.013 local currency per United State Dollar as reported by the Central Bank of Argentine Republic. Retrieved from http://www.bcra.gov.ar/estadis/es030102.asp.
10. The used exchange rate was of 4.11 local currency per United State Dollar as reported by the Central Bank of Argentine Republic. Retrieved from http://www.bcra.gov.ar/estadis/es030102.asp.
11. Using an average exchange rate, for the period, of 3.923 local currency per United State Dollar as reported by the Central Bank of Argentine Republic. Retrieved from http://www.bcra.gov.ar/estadis/es030102.asp.
12. Usually innovation systems are studied as a national aggregated approach but it is, also, an approach of particular interest at the sub-national level of sector and region. In this way it is possible to identify effects of the differentiated technological dynamics of each sector and/or region within a particular country.
13. This includes institutions involved in the early stages of the innovation process: those devoted to research and development (R&D), the labour market, the education system, financial institutions, regulatory structures, and other institutions that shape economic dynamics more broadly.

References

Anllo, G., R. Bisang, and G. Salvatierra. 2010. *Structural Changes in Agricultural Activities. From the Primary to the Global Chains Value.* Santiago, Chile: Economic Commission for Latin America and the Caribbean (ECLAC). Retrieved December 13, 2010 (http://biblioteca.cepal.org/record=b1187705~S0*spi).

Bisang, R. and G. E. Gutman. 2005. "Agri-food Networks and Accumulation: Reflections on the Recent Experience in the MERCOSUR." In *Redes, Jerarquías y Dinámicas Productivas: Experiencias en Europa y América Latina*, edited by M. Casalet, M. Cimoli, and G. Yoguel. Buenos Aires, Argentina: Miño y Davila.

Brieva, S. 2006. "Socio-technique Dynamic of Agricultural Production in Peripheral Countries: Technological Configuration and Re-configuration in the Production of Soy and Wheat Seeds in Argentina." Doctoral Dissertation, Buenos Aires, Argentina. Retrieved March 3, 2010 (http://www.flacso.org.ar/uploaded_files/Publicaciones/Tesis_Susana_Silvia_Brieva_vd.pdf).

Chudnovsky, D., A. López, M. Rossi, and D. Ubfal. 2006. "Evaluating a Program of Public Funding of Scientific Activity. A Case Study of FONCYT in Argentina." Working Paper: OVE/WP-12/06, Office of Evaluation and Oversight, OVE Inter-American Development Bank, Washington. Retrieved December 12, 2011 (http://ove/oveIntranet/DefaultNoCache.aspx?Action=WUCPublications@ImpactEvaluations).

COVIAR. 2004. "Strategic Plan Argentina Vitivinícola 2020." Corporación Vitivinícola Argentina. Retrieved Febreury 6, 2009 (http://www.vitivinicultura2020.com.ar).

Ghezán, G., M. Mateos, and J. Everdín. 2001. "Impact of Policy of Structural Adjusting in Agricultural and Agroindustrial Sectors: The Argentina Case." *Serie Desarrollo Productivo No. 90*. Santiago, Chile: Economic Commission for Latin America and the Caribbean.

Gutman, G. E. and P. Lavarello. 2002. "Recent Transformations of Food Processing Industry in Argentina: Transnationalization, Concentration and Technological (Un)Chaining." *Revista Interdisciplinaria de Estudios Agrarios No. 17*. PIEA.

Harty, C. 2010. "Implementing Innovation: Designers, Users and Actor-Networks." *Technology, Analysis & Strategic Management* 22(3):297-315.

INTA. 2011. *Report of Projects Portfolio 2009-2011 and PROFEDER. Synthesis.* Instituto Nacional de Tecnología Agropecuaria. Retrieved August 23, 2011 (http://intranet.inta.gov.ar/documentacion-institucional/informes-de-gestion/10%20-%20Informe%20Cartera%20de%20Proyectos%20%20y%20PROFEDER%202009-2011.doc).

Kadura, B., J. Langbein, and K. Wilde. 2011. *Strengthening Innovation Systems. Foundation, Concept and Strategic Approach.* Hamburg, Germany: Verlag Dr. Kovac.

Latour, B. 2005. *Reassembling the Social—An Introduction to Actor—Network Theory.* New York, USA: Oxford University Pres.

López, A., A. M. Reynoso, and M. Rossi. 2010. "Impact Evaluation of a Program of Public Funding of Private Innovation Activities. An Econometric Study of FONTAR in Argentina." Working Paper: OVE/WP-03/10, Inter-American Development Bank Office of Evaluation and Oversight. Retrieved December 12, 2011 (http://www.iadb.org/ove/DefaultNoCache.aspx?Action=WUCPublications@ImpactEvaluations).

MinCyT. 2008a. *Indicators of Science and Technology. Argentina 2008.* Ciudad Autónoma de Buenos Aires, Argentina: Ministerio de Ciencia, Tecnología e Innovación Productiva (Ministry of Science, Technology and Productive Innovation). Retrieved September 9, 2011 (http://www.mincyt.gov.ar/multimedia/archivo/archivos/Indicadores_WEB4mb.pdf).

——. 2008b. *Agri-food Technological Statistic Report.* Ciudad Autónoma de Buenos Aires, Argentina: Ministerio de Ciencia, Tecnología e Innovación Productiva (Ministry of Science, Technology and Productive Innovation). Retrieved December 14, 2011 (http://www.mincyt.gov.ar/multimedia/archivo/archivos/bet_agroalimentos.pdf).

Nelson, R. 2007a. "Economic Development From the Perspective of Evolutionary Economic Theory." *The Global Network for Economics of Learning, Innovation, and Competence Building System (GLOBELICS). Working Papers Series No. 2007-02.* ISBN 978-970-701-963-8. Retrieved July 7, 2010 (http://dcsh.xoc.uam.mx/eii/globelicswp/wpg0702.pdf).

——. 2007b. "Institutions, Social Technologies, and Economic Progress." *The Global Network for Economics of Learning, Innovation, and Competence Building System (GLOBELICS). Working Papers Series No. 2007-03.* ISBN 978-970-701-963-8. Retrieved July 7, 2010 (http://dcsh.xoc.uam.mx/eii/globelicswp/wpg0703.pdf).

Nogues, J. and A. Porto. 2007. *Economic and Social Impacts Evaluation of Public Policies in the Agroindustrial Chain.* Buenos Aires, Argentina: Foro de la Cadena Agroindustrial Argentina. Retrieved June 26, 2011 (http://www.foroagroindustrial.org.ar/medio.php).

Pavitt, K. 1984. "Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory." *Research Policy* 13:343-373.

Pérez, C. 2010. "Technological Dynamism and Social Inclusion in Latin America: A Resource-Based Production Development Strategy." *CEPAL Review* 100:121-141. ISBN 978-92-1-121724-7. Retrieved December 20, 2011 (http://www.eclac.cl/cgi-bin/getProd.asp?xml=/revista/noticias/articuloCEPAL/2/40532/P40532.xml&xsl=/revista/tpl-i/p39f.xsl&base=/revista/tpl-i/top-bottom.xslt).

Ruiz, A. M. and J. A. Vitale. 2011. "Foresight and Strategy: The Case of the Viticulture Strategic Plan 2020 (PEVI)." *Estudios Socioeconómicos de los Sistemas Agroalimentarios y Agroindustriales, Nro. 7.* Buenos Aires: Ediciones Instituto Nacional de Tecnología Agropecuaria. ISSN: 1852-4605.

Sanchez, G. 2010. "Insertion of INTA in Innovation Networks of Different Sub National Agri-Food Production." Master Dissertation, Universidad Nacional de Gral. Sarmiento, Los Polvorines, Buenos Aires, Argentina. Retrieved June 30, 2010 (http://www.ungs.edu.ar/areas/pos_tesis/75/insercion-del-inta-en-redes-de-innovacion-de-diferentes-tramas-agroalimentarias-regionales.html).

Sanchez, G. and R. Bisang. 2011. "Learning Networks in Innovation Systems at Sector/Regional Level in Argentina: Winery and Dairy Industries." *Journal of Technology Management & Innovation* 6(4):15-32. ISSN 0718-2724.

Schumpeter, J. A. 1976. *Capitalism, Socialism and Democracy.* New York: Harper and Row.

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