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THE DEVELOPMENT OF A NEW TECHNOLOGICAL INFRASTRUCTURE IN ARGENTINA

David Slomsky

Introduction

In fewer than five years, Argentina has made an incredible economic turnaround from a state of economic instability to that of arguably more growth potential than any other country in the world. However, many aspects of the economy have been unable to advance with such a rapid progression of economic rebuilding. Technological development in Argentina has not been a concern of the government in over fifty years and was not a concern in the recent redevelopment of the Argentine economy. Yet, a strong technological infrastructure is an essential part of any successful economy, and building one will now have to be a primary concern for the Argentine government.

As can be surmised from Argentina’s history of technological policies, Argentina has developed an adaptation strategy rather than a creation strategy for technological development. This means that Argentina imports products from other countries and then adapts them to Argentine customs and needs, such as by redesigning the inside of refrigerators to conform to the habits of society. Argentine engineers have also tried to improve the efficiency and quality of many of the products that are imported. (Carelli) This strategy has developed for two main reasons. First and foremost, it is much cheaper for Argentina to purchase technology than to develop it, especially since the country has no strong technological base from which to start. This strategy has been complemented by the fact that the world’s informational infrastructure is becoming much more open. Second, a good technology policy is not as essential to turning around an economy as it is to maintaining an already established economy.

Argentina must address many considerations in order to build its technological infrastructure. The first is the need to set up research organizations that will initiate and encourage the progress of technological development. Second, strong policies are required to govern these new research organizations. Finally, good communication is needed among the parties concerned with the development of technology, including the government,
research organizations and the industries themselves. Most of the research organizations in Argentina today were developed many years ago; however, there have been no strong governing policies and little communication among the research organizations, the government and the industries.

It is now necessary to define what is required by new technology policies in order to develop a firm foundation. To begin with, there are three ways in which a country gains technology. One is to simply transfer technology from other countries, which can be done through a variety of different means. Secondly, a country can gain technology through its own research and development, whether by private enterprise or the government. A third way is for a country to combine information obtained from foreign countries with its own domestic technology. New technology policies in Argentina must address concerns such as financing of organizations and providing incentives for companies to utilize national technology development techniques.

In this paper I will explore the ways in which Argentine policies concerning both the development and transfer of technology must change to establish a more productive technological infrastructure. I will begin by examining the problems encountered with past policies. Then, I will explain how the current developmental policies and organizations are being integrated into one fluid system. Finally, I will discuss how Argentine companies are better transferring technology from other countries to integrate with their own domestic research and development.

History of Argentina's Technology Policies

The key to understanding both Argentina's problems with the development of technology and what must now be done to generate a new technology infrastructure lies in examining the past. Many of the problems in the technology domain stem from a lack of interest in the field, due mainly to the country's political and economic instability. This lack of interest, characteristic of both the government and industry, led to inadequate university training, poor communication and weak state policies. There was also very little active research being performed by either the state or private entrepreneurs, and a lack of incentives for potential research of new technology by the government. Finally, no real network of agencies or classification systems for technology regimes ever developed. (Nelson, p. 451) Although attempts have been made to overcome some of these problems, in the end there has not been enough interest shown by government or the industry to support the needed changes.

Beginning in the mid-1930s and continuing into the 1940s, Argentina, like many other developed economic nations at the time, was beginning to develop programs and organizations that would generate technology and look toward the future. These organizations, however, were few in number and had little contact with the industries themselves. For Argentina, the 1950s was the time when the technology developmental organizations flourished. CNEA, INTA, INTI and CONICET, organizations to be discussed later, were all formed between 1951 and 1958. (Adler, pp. 105-108)

However, the boom in the formation of technology organizations did not coincide with the domestic developmental technology policies. During the 1950s and early 1960s there was a desire for a strong anti-dependency program — a program in which the government imposes strict importation laws on technology transfer into the country to stimulate the advancement of domestic technology development. The industries at this time were growing so much faster than the support for domestic technology that a laissez-faire policy was the most effective and most natural plan to develop. Instituting laissez-faire policy ensures that the government will have very little control over the importation of technology and therefore allows foreign companies to invest in the country, bringing with them their previously developed technology. (Adler, pp. 105-108)

After a small period of anti-dependency in the early 1960s, a military regime took control of Argentina in 1966. The regime brought with it a different style of laissez-faire policy, one in which the government actually repressed the universities and organizations dealing in technology advancement by not funding them and
not giving them the necessary resources needed to continue their research. In this new laissez-faire policy, while the government still took very few steps to control the importation of technology into the country, it also tried to restrain local companies and organizations from developing new technology themselves. This new policy began a confrontation that defines Argentina’s recent technological history. Those in favor of a strong science and technology program and firm restrictions on the transfer of technology into Argentina are opposed by those in favor of a more relaxed program by which technology can be brought cheaply and easily into the country. (Adler, pp. 108-11)

The history of Argentina’s technology policies from then on is very erratic, in direct correlation with its political history. From 1969 to 1972 the government tried to establish another anti-dependency program. However, due to bureaucratic problems stemming from sporadic governmental opposition, the program was not instituted until September 1973 when Juan Perón regained the presidency. Perón tried to establish a strong anti-dependency program by enacting tough new measures against foreign technology transfer into Argentina. However, at the time the country was in such serious financial difficulty that it lacked the ability to effectively start a new domestic technology program. Perón’s half-year in office was not enough time to establish the new program, and in 1976 new counter-nationalist anti-dependency policies were set up and a laissez-faire technology accumulation policy again took hold. From 1976 to the late 1980s and early 1990s a lack of interest and attention to the development of technology in Argentina led to a fairly stable laissez-faire policy. (Adler, pp. 111-13)

Over the past five years, Argentina has undergone phenomenal economic changes with the opening up of its economy to foreign investors, the privatization of many industries and the substantial reduction of inflation. At first this meant an expansion of its former laissez-faire policies; but in recent years Argentina has begun to develop its own technological infrastructure, one which will allow for effective domestic research and development. It is hoped that a combination of these two formerly competing policies — laissez-faire and anti-dependency — will thus help to build a stronger industrial base to support the new economy.

**Technology Development Policies**

The first step in integrating an anti-dependency program with Argentina’s former laissez-faire policy is to develop a structure in which effective research and development can be conducted domestically. The primary goal of Argentine technology development policies in recent years has been to link industry with the research being conducted. The research centers and industries must begin to work together through programs set up by both the universities and other technology organizations, while also keeping in close communication with the government. (Magliano) Accomplishing this goal should be an easy task since industry, research organizations and universities all have a natural need to satisfy technological demand. Small and middle size companies simply do not have the capital to buy new technology, so they need the universities in order to face the challenge of the international markets. (Magliano) The government has also convinced many of the larger companies, which may not benefit as much from university assistance, to get involved in domestic research programs. Both international companies, such as IBM, and domestic privatized companies, such as YPF (the recently privatized oil and gas company in Argentina), are involved in organizations to help develop domestic technology and create an Argentine technological infrastructure. (Magliano) However, other companies refuse to participate in these new programs for fear that they will not profit from the enterprise. For example, Bunge and Born, the largest holding company in Argentina, sees no need to develop technology when it is so easy and cheap to purchase from world markets. (Sturezenbaum)

In the next few sections I will explain the various research organizations established in Argentina today. I will then proceed to explain the efforts being made to coordinate these organizations with the government.
Financing of Research Organizations

One of the ways in which governments maintain laissez-faire policies is by not financially supporting university and industrial research programs. In Argentina the financing of public technology development organizations, institutions and agencies (such as the University of Buenos Aires) has not always been at the top of the government's agenda. For example, in 1988 Finalidad 8, the science and technology item of the government's budget, was only allocated $380 million. While $50 million went to the privatization of public companies, ninety percent of the remaining budget was allocated to eight institutions and agencies. Although the universities are getting a larger share of funds today, in 1988 only $30 million was allotted to university research. (Adler, p. 127) The university system, along with some other research organizations that received government funding, will be further discussed below.

Argentine Research and Development Organizations

CNEA (The Atomic Energy Commission) traditionally receives the largest portion of money going to the research agencies because of Argentina's strong military tradition. Only recently have modest cutbacks in the funding for CNEA begun to develop due to the discovery of some large untapped natural gas reserves in the country. These gas reserves are lessening the demand for atomic energy. The goal of CNEA in the past had been to develop Argentina's atomic technology on its own. A disturbed political history has brought about a variety of policy changes throughout the years, making joint research on such a volatile subject as nuclear energy very difficult. More recently, however, CNEA has done what most other technology development sectors have done: it has gone abroad, but not just to purchase technology. Many CNEA scientists have traveled abroad to train in physics, metallurgy, radiobiology and material sciences. Also, in recent years Argentina has formed a number of joint ventures with foreign private firms, especially in Germany and the United States, to produce atomic energy in Argentina. (Nelson, pp. 467-68)

In 1958 CONICET (The National Council for Science and Technology) was established "to coordinate and promote scientific and technological research and to advise the national government on such matters." (Adler, p. 106) In its early years CONICET was ineffective because it had no decision-making power and was reduced to acting as an advisory board to the government officials. However, as it grew the organization became more proactive. One way in which CONICET has tried to pursue its goals is by awarding fellowships for studying abroad to both university students and professors. (Adler, pp. 106-107) Perhaps the council's most significant accomplishment came in 1985 when it set up a Technology Transfer Office, which was designed to help link research institutions with companies in need of research and development. Today, CONICET is active in fashioning many new contracts in such areas as petrochemicals and biotechnology both between firms and between research agencies. (Nelson, p. 467)

Two other government organizations were created to help propagate technology development in industry and agriculture. INTI (The National Institute for Industrial Technology) was formed in 1957 with a goal of "providing technical services to industry through laboratories and a network of research centers." (Adler, p. 107) Most of the financing for this organization comes from a 0.25 percent tax on all bank credits to industry. Financial assistance was supposed to be a goal of the organization originally; however, that aspect never unfolded. (Adler, p. 107) The other organization created to help propagate technology development is INTA (The National Institute for Agricultural Technology), and it is INTI's agricultural counterpart. It is the charge of this organization "to promote and coordinate research in the agricultural sector through a complex network of research stations." (Adler, p. 107) Financing for regional experimental farms and the thirty research programs that INTA helps support comes from a 1.5 percent tax on all agricultural exports. (Adler, p. 107) In recent years, INTA has been trying to promote the development of more hybrids and pesticides. In the past, a lack of technological...
development in these areas has allowed large multinational firms to dominate. Although INTA has not yet exploited world markets, it has had some success with more efficient implementation of agricultural equipment, production of organic technology, production of new fertilizers, development of new agrochemicals, and harvesting of new crops, such as soybeans. INTA has also helped to save the Argentine small farmer in a time of large company dominance by promoting the subcontracting of farming by larger agricultural companies. (Nelson, pp. 468-69)

The University System and Technology Development

Perhaps the most important organization concerning the future of Argentina's technology development infrastructure is the university system. It should be noted that the university system in Argentina is a public system in which the universities are on average much larger than in the United States. The largest university in Argentina is the University of Buenos Aires, which services more than 120,000 students.

The university system first became involved in the redevelopment of the technology system by reorganizing the structure of research programs. The first step in this reorganization was to change university policies to allow university researchers to perform research for private companies rather than just for their own interests. This step, which was accomplished in the late 1980s and early 1990s, allowed the universities to abandon the pursuit of nonproductive but interesting research, and instead to begin conducting research that would be directly applicable in the engineering field. The universities were also required to define their specific faculties. As an example, the University of Buenos Aires set up the following 13 faculties: Facultad de Agronomía, Facultad de Arquitectura, Facultad de Ciencias Económicas, Facultad de Ciencias Exactas y Naturales, Facultad de Ciencias Sociales, Facultad de Ciencias Veterinarias, Facultad de Derecho, Facultad de Facultad de Farmacia y Bioquímica, Facultad de Filosofía, Facultad de Ingeniería, Facultad de Medicina, Facultad de Odontología and Facultad de Psicología. Each of these faculties has also set up various programs of research within its own faculty. (Magliano)

Integrating the Government, the Industry and the University System

A very significant accomplishment of the University of Buenos Aires in recent years is the establishment of an organization called UBATEC S.A. (University of Buenos Aires Technology). The goal of this organization, which was founded in 1992, is to unify the academic, business and municipal sectors of the technology environment and to profitably transfer technology through the Transfer of Technology Network. Unifying these sectors includes providing better avenues of communication and better means of working together to accomplish mutual goals. UBATEC, a private company, is the managing partner for four other associations: UBA (University of Buenos Aires), UIA (Industry Union Argentina), CGI (General Confederation of Industry) and M.C.B.A. (Municipality of the City of Buenos Aires). The UIA represents larger enterprises, while the CGI is an agent for smaller, less-well-known companies. UBATEC S.A. is the first organization of its kind to organize all sectors of the technology environment in Argentina. Organizations such as CONICET, INTA and INTI have been trying to develop their own specific interests for years, but have not succeeded in unifying the technology environment as a whole. (Magliano)

Technology Transfer Policies

The goal for technology development in most countries is not to become totally autonomous, but rather to maximize the level of efficiency in the accumulation of technology. In many cases, therefore, it is worthwhile to gain technology from a source outside the country itself as well as to develop domestic technology. There are many advantages to acquiring technology from foreign countries, such as cost effectiveness, complexity of knowledge and speed of acquisition. (Sturezenbaum)
Modes of Transferring Technology

Although advantageous, acquiring technology from foreign countries can be very complicated. Transferring technology from one country to another does not simply mean buying and selling information. Actually, there are seven modes of transferring technology as described by Emanuel Adler in his book, *The Power of Ideology*, three of which deal with the transfer of knowledge. Technical assistance, the first of the modes, involves assigning foreign experts to local research and development groups, as well as sending domestic experts abroad to gain knowledge that they may bring back to a local project. Technical assistance can be accomplished by forming joint ventures, by directly investing with foreign companies or by contracting with foreign organizations. The United Nations Development Program, the World Bank and many private foundations are involved in financing projects such as these. (Adler, pp. 54-57) Numerous instances of this type of transfer of knowledge are present in Argentina today. The university system is setting up programs to send both students and professors overseas to universities such as MIT and Harvard. The University of Buenos Aires has also set up a National Interuniversity Council, which directs the operation of thirty national universities in foreign countries. (Adler, pp. 54-55) There are also multinational companies, such as Arthur Andersen Consulting, that send people all over the world to train and then return them back to Argentina to work. Many of these large multinational companies have also been helped in the transfer of technology by the new CD-ROM instruments and personal computers. (Vazquez) It is now much easier to send technology to less developed countries such as Argentina.

The second technique for transferring knowledge is through the purchase of knowledge-generating capital equipment. Even though the equipment is bought from a foreign country, it must be maintained within the country that purchased the equipment. Through the maintenance and operation of this equipment a pool of knowledge develops in the specific areas. This technique has been used by the telecommunications industry during the recent privatization of ENTEL (the Argentine telephone company) and also in the development of shipyard equipment. (Adler, p. 55)

The actual purchase of technology is the final means for the transfer of knowledge. In this case, local companies must first acquire the rights to foreign patents. Acquiring these rights may be complicated because each country has its own patent laws, and many countries have only recently begun developing laws to regulate the transfer of patents across international borders. It also may be hard to locate countries willing to sell advanced technology. (Adler, p. 55) In 1993 Argentina signed a pact with the United States government in which Argentina would place more controls on its strategic exports. In return the United States agreed to sell sophisticated computer equipment, nuclear technology and aeronautical-guidance systems to Argentina. (“Technology Pact...,” p. 215)

The next three ways in which technology is transferred are each characterized by the obtaining of capital goods from foreign countries. For example, an Argentine company may purchase the parts to a product abroad, but assemble the final product at home. Although this process does not transfer much technological knowledge, it does increase the demand for other newly developed products at home that are needed to complement the foreign products. The automobile industry in Argentina is a prime example of how imported foreign products may spur the development of new technology at home. Bringing to Argentina the original equipment for the automobile factories from foreign countries created the incentive to gain more domestic knowledge about the industry, thus increasing domestic automotive technological development. Not only is it cheaper to develop Argentine automobile products similar to foreign products, but it is also cheaper to develop Argentine replacement parts for the original imported equipment. (Adler, pp. 55-56)

Another (and more common) technique of gaining capital equipment that brings about greater use of domestic technology involves the contribution of both foreign and domestic parts to a finished product. This technique encourages Argentine companies to use the guidance of foreign and multinational firms to help devel-
op capital equipment in their own country, without excluding the companies' own researchers and developers. (Adler, p. 56)

The final technique involved in gaining technology through capital equipment from abroad does not include the transfer of capital equipment parts to Argentina, but rather the transfer of total systems. Multinational firms will develop the system overseas and then ship it to Argentina. These systems can include anything from new computer systems to whole factories or power plants. (Adler, p. 56) For instance, Whirlpool of Argentina bought an entire factory, including the machinery, from a Brazilian company to produce two-door refrigerators. (Carelli)

The last way in which Adler sees technology being transferred is through joint ventures. Joint ventures here usually involve a national and multinational firm working together to establish a company in Argentina. After the company has successfully been established, which may include transfer of both capital equipment and technological knowledge, the foreign company pulls out and allows the national firm to take over all operations. (Adler, pp. 56-57)

In most cases multinational as well as national firms use a combination of the above seven techniques to transfer technology to Argentina. For instance, Bunge and Born purchases the machinery for empanadas, which are a favorite Argentinean food, from Japan. Both transfer-of-product and maintenance-of-equipment techniques are utilized by this purchase. Bunge and Born also utilizes technical assistance techniques by working with experts in Australia to develop what it calls "perfect" pork cold-cuts. (Sturezenbaum)

The University System's Technology Transfer Organization

Whatever technology transfer techniques are implemented, they must be used in accordance with Argentina's technology transfer policies. As mentioned earlier, throughout Argentina's history policies have changed from ones in which technology transfer from foreign countries was encouraged to ones in which it was discouraged. As in the case with developmental policies, there has been a lack of communication between the industry and government regarding transfer policies. (Magliano)

The University of Buenos Aires recognized the problem and has come up with a solution. In 1985 the university became involved in the transfer of technology by setting up a new office for the purpose of increasing communication between the government and industry. Its most significant achievement so far has been to help formulate a new transfer-of-technology law, which was enacted in 1990. This new law keeps the transfer of technology relatively open by allowing a great deal of freedom to import to international firms working in Argentina. However, in light of the need to integrate both domestic and foreign technology, the new law has also allocated funds in the national budget for companies to hire both public and private groups to develop needed technology. (Magliano)

Conclusion

Good communication, high quality research organizations, and well-developed technology policies are the building blocks upon which Argentina is developing its new technological infrastructure. UBAFEC and the University of Buenos Aires' technology transfer office have established a viable communications system among industry, research organizations, the universities and government. This new communications system has allowed the government to institute strong policies governing the development and transfer of technology in Argentina today. In turn, research organizations are beginning to develop more effective ways of conducting research essential to industry, rather than merely to the interests of the researchers themselves.

A key to the success of the new policies adopted by the Argentine government is the integration of developmental and transferal policies. The new open economic policies have allowed many multinational companies to establish themselves in Argentina, bringing with them their own technology. With an open economic policy, the transfer of technology will occur whether or not the national government has strong developmental policies of its own. As a result, the Argentine government has
decided to pursue both modes of accumulation of technology. It has also realized that these two policies are not necessarily conflicting. Many of the transfer-of-technology techniques discussed include ways in which new technology could be developed in Argentina. Joint ventures, in particular, allow Argentina to receive assistance in developing its own technology, while preventing foreign firms from becoming the dominant factor in this process.

If the development and transfer of technology in Argentina continues along these same lines, the technology infrastructure will eventually catch up to the progressing economy. The building blocks have been set in place, and now the actions that these new policies are governing must be well executed. One of the major obstacles to the development of an Argentine technology infrastructure in the past has been an unstable government. Menem’s new government appears stable so far, which has resulted in a solid economy, thus giving a chance for firm technology policies and the development of a strong technological infrastructure.

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