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New Trends in Argentina's Science, Technology and Innovation Policy

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Purpose

The brief describes the historical evolution of the national policy of science, technology and innovation (STI) in Argentina, identifying major turning points from the period of the import substitution model that lasted for 40 years to the current development pattern still in the making, with a sharp shift during the 1990s to a harsh market-led path. Domestic learning processes and emerging international trends led Argentina in the new millennium to adopt a new more proactive, flexible and participatory model of STI, which was further pushed by the creation of the Ministry of Science, Technology and Productive Innovation in 2007. The National Plan of STI 2012-2015 reflects on-going efforts to deepen the redesign of research, technology and innovation policies.

The Redesign of STI Policies and Institutions

Science, technology and innovation policies and institutions in Argentina constitute today an evolving system whose configuration is the result of a several-stage process involving discontinuity regarding priorities, approaches and intervention modalities.

STI policies over most of the 90s implied a significant shift with regards to the pattern prevailing during the four-decade model of import substitution industrialisation (ISI). In a nutshell, this shift involved a drastic move away from state support to the development of basic science and of human resources, as well as from direct public intervention in some sectors deemed strategic or at the technological frontier. The new pattern, framed within a economic policy stressing the opening and deregulation of the economy and the privatization of public assets, strongly emphasized the modernization of the private sector under a quasi-market rationale and made the first moves towards a greater articulation and coordination of STI public institutions. In line with this pattern, a demand-driven approach,

under the assumption that firm knowledge requirements set research and development (R&D) lines, and sectoral neutrality (i.e., massive horizontal policies favouring stronger links of individual firms with the supply of advising and training services) set the tone of STI policies.

By the end of the 90s, a more complex set of policies was implemented in order to address the increasingly heterogeneous capacities of the private sector to generate and absorb scientific and technological knowledge, the different "stages of the innovation cycle" and the need to target support by sectors. This shift towards greater policy differentiation and directionality as well as deeper integration and coordination of the national system of STI was invigorated since 2003. Particularly, the creation of the Ministry of Science, Technology and Productive Innovation (MINCYT) in 2007 was a big push in that direction as it gave room to a process of increasing prestige and institutionalization of the STI; this process fuelled, in turn, an important redirection of the rationale for policy intervention.

Three main aspects distinguish this rationale shift: the greater emphasis granted to a systemic vision of support to innovation based on the construction of stronger



links with the science and technology dimension; the deepening of the shift from horizontal to more focalized policies; and the gradual move from support targeting individual actors (firms or institutions) to support stressing different types of associative behaviour (value chains, consortia, networks, etc.). This reorientation of the rationality for policy intervention was grounded in the need of the MINCYT to adapt its strategic goals and policies to the particular traits of the context in which it operates, in particular the mounting relevance of technological change and innovation for internation-

al competitiveness and the need to upgrade the increasingly complex domestic production structure, the nature of the problems and opportunities calling for public intervention, and the need of a systemic approach in order to enhance the effectiveness of STI policies. This conceptual reorientation has been matched at the instrumental level by the "restyling" of the existing policy instruments as well as the design of new ones in the policy axes that shape today public interventions (see below).

The Conceptual and Empirical Drivers of Policy Changes

The current reorientation of the rationale for policy intervention is in line with STI policy trends in developed countries and in middle-income countries within the developing world. It also echoes academic debates and policy recommendations from technical cooperation agencies.

In the same way, it is also important to foster a greater policy focalization through the identification of strategically significant areas as main targets of STI policies. Of course, this does not imply a return to old-fashioned practices of "picking winners" but instead the previous definition of activities and agents to be specifically targeted because of its relevance for upgrading and diversifying the production structure.

Limits of the Linear Model

The deepest motive of this reorientation, which comprises three main threads with different degree of progress and articulation, is the awareness of the limits of a static or lineal view of the relationship between science, technology and innovation. In fact, believing in a lineal view means that the new scientific and technological knowledge (usually created through R&D) is easily adopted by producers, without any significant participation or feedback about real needs of knowledge production.

Endemic Uncertainty

The second relevant feature of the current production dynamics is not just the increasingly rapid pace of scientific and technological changes and, *pari passu*, of the innovation process but the uncertainty of their direction that has led many people to talk about "endemic uncertainty". Indeed, in an increasing number of production activities as well as in other areas of public interest (for instance, climate change, food safety or health care to mention just a few) it is more and more difficult to predict the next market demand, or, in the same vein, the next natural disaster, animal or plant disease, or virus variety, which will require to create and apply "new generation" scientific and technological knowledge that, in addition, can be rapidly turned into product and process innovations.

Turning to Customized Production

Several traits of the present production situation reinforce the on-going redefinition of policy rationale. The first is the increasing heterogeneity of the production tissue, which cuts across sectorial and even sub-sectorial boundaries. Concretely, in the same sector and macroeconomic context, firm competitive strategies and practices differ along several dimensions, for instance the way they use technology and behave with regards to innovation. This heterogeneity turns horizontal and non-discriminatory policies, usually grounded on "broad range" market failures (complementary financing, imperfect information, coordination deficits and the like) largely ineffective to tackle down producers' specific constraints to develop scientific and technological capabilities and to innovate. What is rather required are policies geared to the provision of "customized" public goods (or "club" goods), in order to attend different needs at different levels of economic activity (firms, clusters, value chains, etc.).

This giant uncertainty calls into question traditional notions of progress such as "technological frontier" or "technological catching up". Knowledge production in these socio-economic and natural contexts calls instead for new policies and institutions that impulse the capacities of agents to search and detect new development opportunities by "de-codifying" them in response to the emerging needs, and to position themselves as providers of precompetitive knowledge for innovation.

The third driver of the reorientation of STI support policies or, to put it more accurately, of the intervention rationale is the fact that innovation – and much of the science and technology knowledge that nurtures it – is the work of inter-organizational networks including firms, public agencies, universities, research centres and other knowledge-producing organizations. Usually born spontaneously, although their emergence is more and more a public policy goal, the distinguishing trait of

these public-private articulations is their role as instances of combination, coordination and synthesis of partial and complementary knowledge and resources coming from different disciplinary domains and fields of activity. These multidisciplinary networks tend to proliferate (though not exclusively) in high-technology activities in which it is highly unlikely that a sole agent have all the capacities and expertise to understand how those technologies work and how to apply them therein.

Specialisation of Argentina's Production

Finally, on empirical grounds, Argentina is no alien to these trends towards increasing heterogeneity of production, acceleration of scientific-technological knowledge and network innovation, although the aggregate data on STI in the country does not properly reflect this. Indeed, in very distinct production activities (farm machinery, wine, technology-based agricultural inputs, nuclear research reactors, screening satellites, television scripts, sport boats, design-intensive clothing, software and boutique off-shore services, among

the most relevant), firms or groups of firms have strongly grown, substantially upgraded production and achieved long-term competitive advantages in the domestic and foreign markets over the past decade on the basis of product and process innovation. These experiences share several features that link them to the above trends. Firstly, all involve the development of collaborative forms of production articulating public and private actors from different disciplines and institutional domains (final producers, part, input and service suppliers, science and technology agencies, universities and research centres in an relative reduced space (regions, counties, urban or semi-urban areas, etc.). Secondly, these networks share different but complementary resources (financial, human, etc.) and knowledge that allow them to identify the accelerating and changing innovation requirements and to generate the production responses to meet them. Finally, they include more or less institutionalized arrangements to coordinate knowledge creation, its application to production, the appropriation of the economic benefits accruing from its exploitation and financing that facilitate interest alignment among stakeholders.

Planning in STI

Under the New Rationale for Intervention

STI planning in Argentina has shown a renewed vigour in the last decade and a particular concern at present to address the challenges posed by the emerging STI environment. In line with this purpose, the planning exercise for the 2012-2015 builds upon two main intervention strategies: the institutional development of the national system of STI and policy focalization.

Institutional development of the national STI system

The first strategy stresses transversal institutional development and changes required to achieve an effective intervention in the current STI conditions; it may be summarized with the productive innovation-institutional innovation formula under the understanding that the latter is a critical necessary condition of the former. This strategy involves the dimensions of capacity building, system linkage, process improvement and learning for network innovation. The assumption is that a system with strengthened endowments of resources and capabilities and, at the same time, better articulation allows to avoid the duplication of initiatives and actions (with the ensuing deficient resource allocation), to identify blind points, to contribute to align interests, to prioritize efforts and to generate synergies both within the public sector and between public institutions

and productive and social actors, among other benefits.

Policy Focalization

As for the focalization strategy, the on-going planning effort has adopted a novel conceptualization centered on the notion of strategic socio-productive nuclei (SSPN). This involves the identification of intervention opportunities in specific domains on the basis of the articulation of general-purpose technologies (GPT: biotechnology, nanotechnology, and ITC) with a bundle of sectors producing goods and services (agro-industry, energy, health, environment and sustainable development social development, and manufacturing). The rationale of this approach is to take advantage of the potential impact of GTP to generate qualitative improvements in terms of production competitiveness, people quality of life and the country's standing with regards to emerging technologies and medium- and long-term foreseeable technological development. In other words, this approach seeks to go beyond the logic intervention driven only by the technological supply or demands requirements; looking forward to generate the conditions to adjust or adapt, if needed, transversal actions and policy instruments to the differentiated needs of selected SSPNs.

Both strategies comprise four operational work axes: coordination (inter-institutional, territorial, international), resources (human, infrastructure, information), processes (regulatory frameworks and monitoring & evaluation),

and policy instruments and financing. The first three axes look at the new architecture, rules of the game, and agency/management capacities of the system of STI. The axe of instruments and financing concerns more horizontal tools to promote the expansion of the science and technology base, the search for selectivity and directionality in the public interventions to foster

innovation as well as the impulse of the connectivity and coordination among STI actors and the mechanisms for funding support policies.

STI Policy Designed to Strengthen the Production Model

The history of STI in Argentina took several models of intervention or no intervention policy under different political rationalities. Nowadays, the development of STI has a greater potential because of the public planning strate-

gies and concrete lines of action according to the production needs of the country. On the whole, this has meant a redesign of public policy institutions in order that science, technology and innovation strengthen the production model by generating greater social inclusion and improving the competitiveness of Argentina's economy, becoming knowledge the backbone of national development.

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