Introduction

Limited innovation in Latin American and Caribbean (LAC) countries impairs the region’s potential to grow and improve its living standards. Ever since the seminal research of Solow (1957), economists have known that technological change, and not only factor accumulation, is critical to growth. Yet, productivity growth in the region is lagging (Figure 1).

The region does not invest sufficiently in innovation nor does it always use scarce resources efficiently. With the exception of Brazil, the majority of countries in LAC invest less in research and development (R&D) than other countries with similar income levels. Moreover, less than 50 percent of R&D investments are financed by private industry, which contrasts with the experience of dynamic global innovators such as China, Korea, and the United States (Figure 2). Public funding of research in LAC has emphasized the generation of conceptual knowledge but has been less efficient at energizing technological innovation such as the production of patents (Figure 3). Collaboration between industry and universities is limited, hindering the transformation of new knowledge into innovation (Figure 4). Universities and industry face different incentives and cultures discouraging productive research collaboration.

While investing in R&D is important, countries in LAC can also attain important productivity gains through the acquisition of existing technologies, especially in sectors where industry is far from the technology frontier. However, for the most part the region has not built efficient support systems for technology extension and dissemination.

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Figure 1: Total Factor Productivity in Latin America Lags Behind Asia (ratios to US TFP)

Source: World Bank staff calculations and projections based on Penn World Tables 6.2, University of Pennsylvania

Figure 2: Private Participation in R&D is Relatively Low in LAC (% of R&D financed by the private sector)

Awareness of the importance of innovation is growing at the public and private sector levels. Public initiatives are underway to start addressing these challenges. This *en breve* reviews good practices emerging in the region to encourage technology transfer and strategic alliances between industry and the academic community, as well as the development of efficient technology extension mechanisms.

Leading universities in LAC have started to build TTOs to interact with the productive sector, but most of them are not yet performing at international levels. The main problems include uncertainties in the incentive structure applied by some universities; lack of commercial focus by some TTOs; insufficient skills in intellectual property management and licensing; limited networks of contacts internationally; and inadequate funding which affects their staffing and access to legal services and necessary contacts. There is a need to rapidly develop effective networks of TTOs and upgrade the quality of services provided by the existing TTOs in LAC. A few initiatives are already underway in the region. The main lessons learned in this area are summarized below.

**Lessons Learned:**
To develop effective networks of TTOs and upgrade the quality of services provided by the existing TTOs in LAC, a multi-faceted strategy is required that includes the issues highlighted below.

**Establish Networks of TTOs:** Developing networks of TTOs is crucial since very few universities have the critical research mass to support the costs of well-functioning entities. In Chile, for example, the five leading universities (which comprise 43 percent of the research conducted by the academic community) and two private sector associations came together to establish a joint TTO (*Oficina de Transferencia de Resultados de Investigación--OTRI*). In Mexico the Government is encouraging its public technology institutes to establish TTOs as networks. This is part of a broader TTO development strategy in Mexico that addresses IP issues and skills and provides some funding to support the generation of an IP portfolio.

**Define Clear Rules on IP Rights:** Establishing transparent rules and appropriate incentives related to the benefits derived from IP is crucial to encourage researchers to commercialize their ideas. For example, the *Fundación Instituto Leloir*, a center of excellence in Argentina, had traditionally followed *ad hoc* policies on IP rights with minimal benefits to researchers. This discouraged technology transfer activities. In parallel to the establishment of a TTO in 2006, it defined new rules on IP that provide appropriate incentives following best practices among OECD countries (Box 1). In Mexico, the Science and Technology Law was amended in 2009 to facilitate the establishment of TTOs by public technology institutes and allow researchers to benefit from the IP that they create. In addition, the Government of Mexico has formulated guidelines on best practices regarding IP rights for universities to adopt on a voluntary basis.

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The expansion of TTOs requires a deepening of specialized skills related to technology and IP management. To this end, the Government of Argentina has supported universities in the development of graduate technology management programs; six programs with World Bank support started operations in mid-2010. In Mexico, the Instituto Tecnológico de Monterrey recently began a technology management program in coordination with the University of Texas.

Facilitating the development of TTOs will require some public seed funding since it takes time for these organizations to develop the necessary capacity and a sufficiently large IP portfolio that can cover costs. As part of the broader strategy to encourage the formation of TTOs, the Government of Mexico is formulating a program to support the development of the IP portfolio of TTOs. This builds on a pilot initiative, Última Milla, which funded the commercialization of ideas by researchers and new entrepreneurs on a matching basis.3

Strategic R&D Alliances between Industry and Research Centers

Limited collaboration between industry and research centers in LAC means that enterprises are not benefiting from knowledge generated by the academic community. In a number of advanced OECD economies, universities and business communities have formed strategic alliances to create knowledge with a specific industrial application in mind. In contrast, these R&D networks are at an incipient stage in Latin America. Policymakers in the region have started to realize their value, and during the past decade several countries in Latin America have launched public initiatives to encourage R&D networks, many of which with support from the World Bank. A few illustrative examples follow.

• Argentina: Strategic R&D alliances are beginning to form in Argentina. Bioceres is a company that focuses on the creation and funding of new companies and research projects related to agro-biotechnology. It started with about 20 shareholders in 2001 and has expanded to more than 200 shareholders, most of whom are innovative agricultural businesspeople and other actors from the agroindustrial sector. The National Institute of Agricultural Technology (INTA) and other research centers collaborate with the company in R&D projects. The Ministry of Science, Technology and Innovation has recognized the importance of these alliances and is providing funding to foster other public-private collaborative research initiatives in strategic economic sectors such as biotechnology, ICT, nanotechnology, and energy.

• Chile: Collaborative programs supported by the Government have funded more than 20 R&D consortia for up to five years. These were among the first collaborative R&D experiences to be launched in all of Latin America.4 Most of these alliances are strongly aligned to the needs of economic sectors such as fruit, wine, and mining. The fruit technology consortium, for example, consists of 29 partners including the exporters’ associations, a diverse group of large, medium, and small fruit exporters and producers and a university. Its core activity is to develop new fruit varieties to compete in demanding international markets.

• Mexico: Public programs to encourage strategic R&D alliances are underway, with more than 40 alliances formed. The aeronautics alliance, which involves several companies in the state of Querétaro together with universities and a public technology institute, constitutes one of the most interesting examples since it is formed around a budding technology sector that is relatively new to Mexico. The alliance is establishing a joint R&D laboratory in aeronautics—the first in Mexico.

Lessons Learned:
Recognize the Complexity of Building Alliances: Most consortia take a long time to develop, in some cases, a year or longer. The parties have to face the difficult issue of building relationships, collective-decision making, and sharing of value created from R&D. The latter is particularly challenging in view of the limited
awareness and experience on management of intellectual property. In many cases, the public agency that provided the funding has become aware of the difficulties and assumed a pro-active role facilitating and accelerating the formation of the consortia. Many of these alliances need to build a critical mass to become competitive on a global basis and could benefit from linkages to international research networks.

Ensure a Clear Governance Structure and Private Sector Leadership: These elements are necessary to shape alliances toward the development of knowledge with high potential impact on the productive sector.

Facilitate Public Funding Support: Public funding support has stimulated the formation of these alliances helping to address several market failures, including coordination failures and the inability to appropriate all of the benefits derived from the R&D. This support needs to be extended on a multi-year basis since the alliances have to undertake R&D work of a long-term nature.

Strategic Technology Extension Mechanisms for Low Technology Firms

Besides encouraging greater R&D production, countries in LAC can enhance productivity through the acquisition of existing technologies produced abroad as well as the dissemination and wide use of other technologies produced domestically. There are particular difficulties in transferring knowledge to firms with very limited technology and minimal capacity and resources.

The Trade Facilitation and Productivity Improvement Technical Assistance project—implemented by the Government of Peru and supported by World Bank financing—illustrates mechanisms that can be developed to facilitate technology extension, with a focus on increasing enterprise productivity and access to export markets. The project helped strengthened a network of technological innovation centers (Centros de Innovación Tecnológica or CITEs) following the model of technology centers in Spain. The ownership and governance structure varied. Some were built on public-private partnerships; others were privately or publicly owned.

In 2010, 14 CITEs operating in Peru provided services to more than 4,000 firms in the agribusiness, wood, furniture and garment industry, logistics and metal machinery sectors. CITEs were designed to enhance the productivity of small domestic firms, including those that wished to export directly or indirectly through another firm. CITEs offered training and technical assistance to help firms address specific technical issues and design templates for production. Some also offered laboratory services to assist firms in the testing of raw materials and final products to meet quality standards required in export markets. CITE Calzado, for example, which focused on the footwear sector, offered laboratory services that enabled firms to test the quality of leather and other inputs. The project, among others, helped four CITE laboratories obtain the ISO 17025 accreditation, the main standard used by testing and calibration laboratories. A recent study has shown increases in the productivity of firms using CITEs’ services.5

Lessons Learned:

Provide Focused Assistance: To be effective, technology providers need to have a sectoral focus where they can develop global expertise and be located close to their target market and clients. Close linkages with universities and research centers have proven critical in enhancing the capacities and know-how of technology centers.

Plan for Long-Term Relevance and Sustainability: When designing such technical assistance schemes, it is crucial to consider the long-term business plan and governance framework. Technology centers managed by the private sector tend to be more agile and efficient. Coordination failures justify some initial public funding on a matching basis, e.g., for capacity building and initial capital outlays, but this should be phased out over a 5 to 10 year period with costs being increasingly financed through service fees. Furthermore, the experience of Spain highlights that technology centers can and need to evolve to remain relevant as firms they provide assistance to progress technologically. The first Spanish technology centers, which were created more than three decades ago to provide training, are now also conducting applied R&D to help firms move towards the technology frontier.

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