CHAPTER SIX

# Better institutions for innovation and productive development

## Abstract

Following a period of structural reform oriented towards free trade and exports, Latin America has turned its attention to strategies for innovation and productive development. The region is currently seeking to insert itself in the global knowledge economy. To do this, it will need to achieve better coordination of actions in this field. Governments, firms, scientific agents and civil society act in a context that has been made more complex by changes in the global economy and by new technological paradigms. Despite these difficulties, many countries have made strides thanks to the creation of institutions, methodologies, and instruments that take on the challenge of innovation and technological change. In order to consolidate these advances, the region needs to support the definition of new models of governance, stronger institutions and models of public policy that can mobilise the agents in the national innovation system. These efforts can motivate the commitment of the private sector in innovation, research and development.

## 6.1. Introduction

Overcoming the challenge of sustainable and inclusive growth will require innovation, i.e. new and "better" products, processes, business models, organisational practices and the creation of new firms. Moving towards this goal will depend on greater co-ordination between policies for innovation and policies for productive development, new forms of public policy governance and a renewed commitment by the private sector to economic growth based on knowledge and innovation.

This chapter is divided into three sections. The first reviews key trends in innovation and productive development in Latin America. The second section analyses the main achievements and challenges in modernising the state to promote innovation. It identifies four main areas in which states have advanced in their capacity to implement more effective policies: the shift towards policy models focusing on innovation systems; the introduction of new modes of governance; the creation of new instruments for financing and technology transfer; and improvements in innovation policy management capacities. The third section proposes some recommendations to consolidate recent gains.

## 6.2. Main trends in innovation and productive development

In the past decade the agenda for innovation has been given new impetus in Latin America. After the 1990s —when countries in the region prioritised growth models based on macroeconomic stability and inflation control— innovation and productive development have returned as priorities in development strategies.

Innovation is a systemic process that arises from voluntary and involuntary interactions between actors operating within different frameworks and with different incentives. For example, businesses respond to competitive market-oriented strategies, while universities, research centres and laboratories perform based on different criteria, not necessarily directed toward the industrial application of advances in knowledge.[1] The quality and intensity of relationships between the actors in national innovation systems are determined by businesses, institutions, incentive mechanisms, regulations and existing infrastructure.

The region needs to encourage further strengthening of national innovation systems, most of which are at an early stage of development. They are often characterised by the presence of "islands of technological excellence" in contexts of low productivity and little business development. It is fundamental to strengthen domestic scientific and technological capabilities, increase the ability to transform these advances into competitive business opportunities and generate qualified employment opportunities to meet both domestic and international demand.

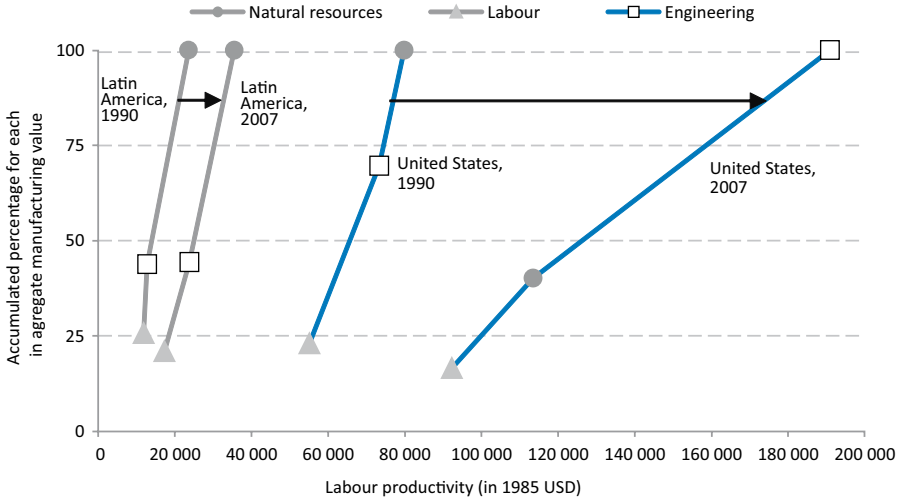
The advances and challenges in innovation and productive development in Latin America today can be summarised in seven main points:

*1)* The productivity gap is a persistent problem. The region needs to invest more to close this divide. A comparison of the dynamics of manufacturing industry productivity between Latin America and the United States shows that Latin America has not caught up to the technological frontier, but in fact the divide has widened in recent years.[2] Between 2003 and 2007, labour productivity grew 2% annually in Latin America. Since the mid-1990s it has grown between 3% and 5% annually in the US, primarily due to the modernisation of productive processes resulting from the increasing incorporation of information and communication technologies in business management.[3]

*2)* The ability to close the productivity gap depends on productive specialisation and the pattern of integration into world markets.[4] The Latin American lag is reflected both in quantity —given the productivity gap— as well as in quality, because of the high sectoral specialisation in natural resource–intensive activities (Figure 6.1). In fact, low productivity growth is associated with the lack of substantive structural change in the region.

Natural resource-intensive sectors still account for 60% of total manufacturing value added, while in the United States, thanks to a strong increase in knowledge-intensive sectors these now represent 60% of total manufacturing value added. This change in the structural composition of its domestic industry almost doubled the country's labour productivity between 1990 and 2007.[5]

**Figure 6.1. Production structure specialisation and labour productivity: Latin America and the United States, 1990-2007**
(In percentages)




*Note:* The natural resource, labour and engineering intensive sectors correspond to the activities in divisions 15-17, 20-21, 23-24 and 26-28; 18-19, 22, 25, and 36-37; 29-35 of the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3), respectively.

*Source:* ECLAC (2010a).
http://dx.doi.org/10.1787/888932523063

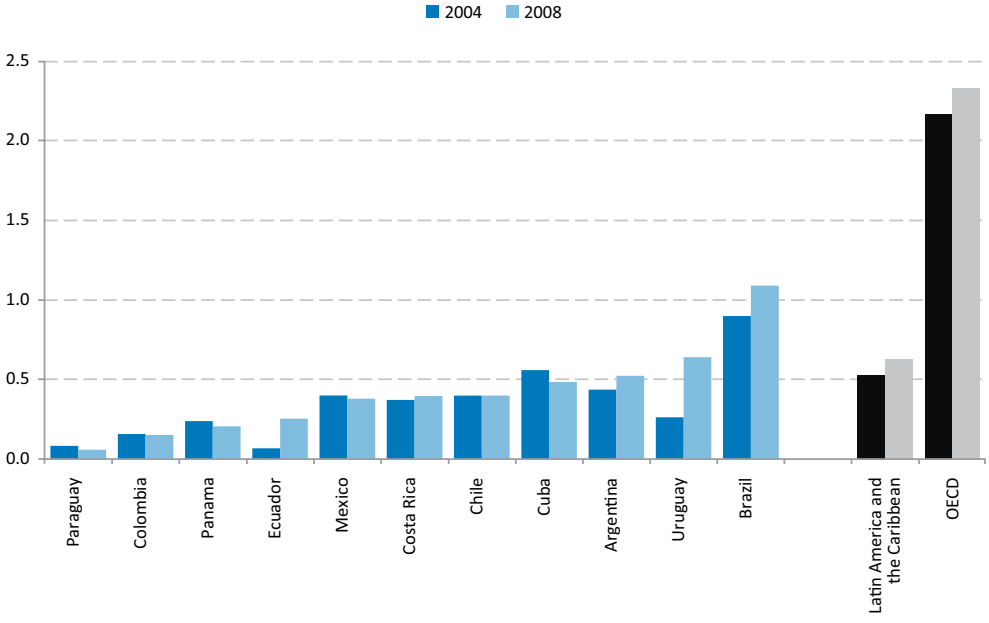
*3)* Primary products and natural resource–based manufactures account for over 50% of the region's exports,[6] so diversifying exports and, therefore, the production structure is a priority. In recent years there has been a process of "commoditisation" of exports, mainly driven by the increase in demand for primary products and their rising prices. The export structure in Latin America contrasts with that of many OECD economies, which are characterised by product diversification and concentration in medium- and high-tech manufacturing. There are three main groups of countries in Latin America: the Southern Cone countries, concentrating in primary products and natural resource–based manufactures; Central American countries, specialised in low- and medium-tech manufacturing; and a group consisting of Costa Rica, Mexico and Brazil, with the highest degree of diversification of exports in the region, including medium- and high-tech manufactures.

*4)* There is a mismatch between supply and demand of skilled human resources for innovation. It is necessary to increase both the quality and quantity of human resources for innovation and create incentives for labour absorption. This

challenge is crucial for all countries in Latin America. For example, Argentina and Uruguay are characterised by a high level of education and need to move towards the co-ordination of educational and productive development policies in order to improve the competitiveness of their productive sectors. Brazil, on the other hand, must strengthen the technological intensity of its productive matrix and needs a training policy in line with this effort, while the smaller countries of the region that suffer from intensive "brain drain" need to attract and retain skilled human capital.

*5)* Latin American investment in research and development (R&D) as a percentage of GDP is less than a quarter of the level found in OECD economies. Investment in R&D as a share of GDP rose from 0.5% in 2004 to 0.6% in 2008; this percentage is much lower than in OECD economies (2.2% and 2.3% for the same years). Heterogeneity with respect to investment in R&D among countries in the region has increased in recent years; for example, Central American investment in R&D does not exceed 0.1% of GDP, while in Brazil it represents 1.2% of GDP.

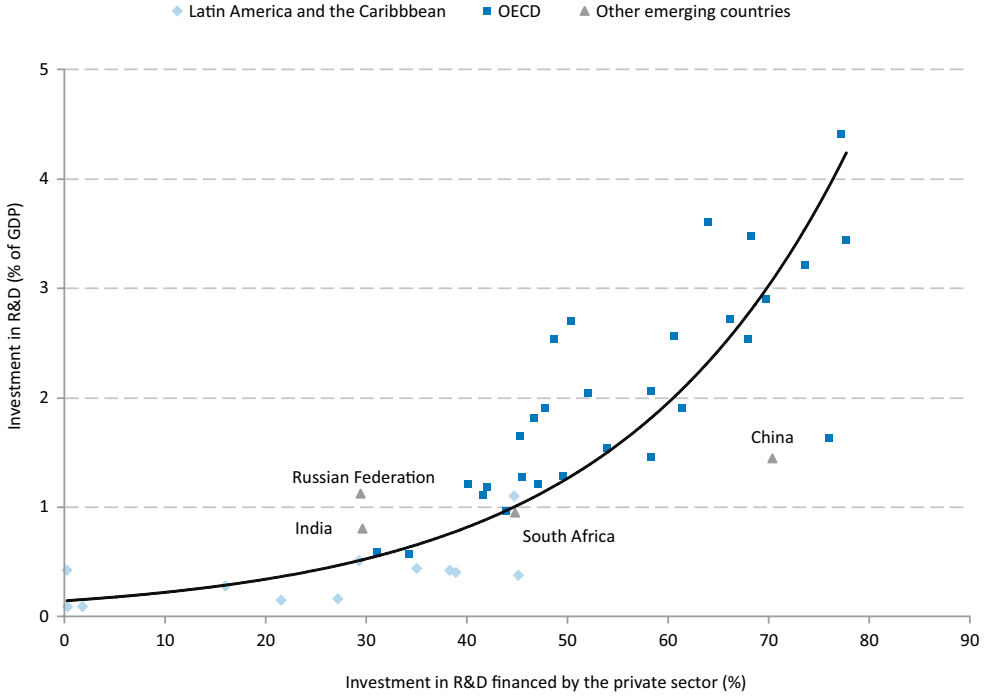
**Figure 6.2. Investment in research and development as a percentage of GDP: Latin America and the Caribbean (selected countries), 2004-08**
(In percentages)




*Source:* Based on data from the United Nations Educational, Scientific and Cultural Organization (UNESCO), see [http://www.uis.unesco.org/pages/default.aspx] Ibero-American/Inter-American Network of Science and Technology Indicators (RICYT), see [http://ricyt.org] and Main Science and Technology Indicators (MSTI) Database of the Organisation for Economic Co-operation and Development (OECD).
http://dx.doi.org/10.1787/888932523082

*6)* The private sector invests little in innovation and R&D. Unlike in developed countries, in Latin America the private sector contributes little to innovation (Figure 6.3). The gap in R&D cannot be closed without a substantial increase in private-sector investment, along with greater support from the public sector. Therefore, it is essential to move forward in designing incentives and policies to encourage private-sector investment in innovation activities. This requires co-ordination between policies for technology and innovation and policies for productive development.

**Figure 6.3. Latin America and the Caribbean, other emerging countries and the OECD: business investment in R&D as a percentage of GDP, 2007 or the most recent year for which data is available**
(In percentages)




*Note:* Figures correspond to the year 2002 for Bolivia; 2004 for Switzerland; 2005 for Panama and Paraguay and 2006 for Australia, China, Israel and South Africa.

*Source:* Based on data from the United Nations Educational, Scientific and Cultural Organization (UNESCO), see [http://www.uis.unesco.org/pages/default.aspx] Ibero-American/Inter-American Network of Science and Technology Indicators (RICYT), see [http://ricyt.org] and Main Science and Technology Indicators (MSTI) Database of the Organisation for Economic Co-operation and Development (OECD).
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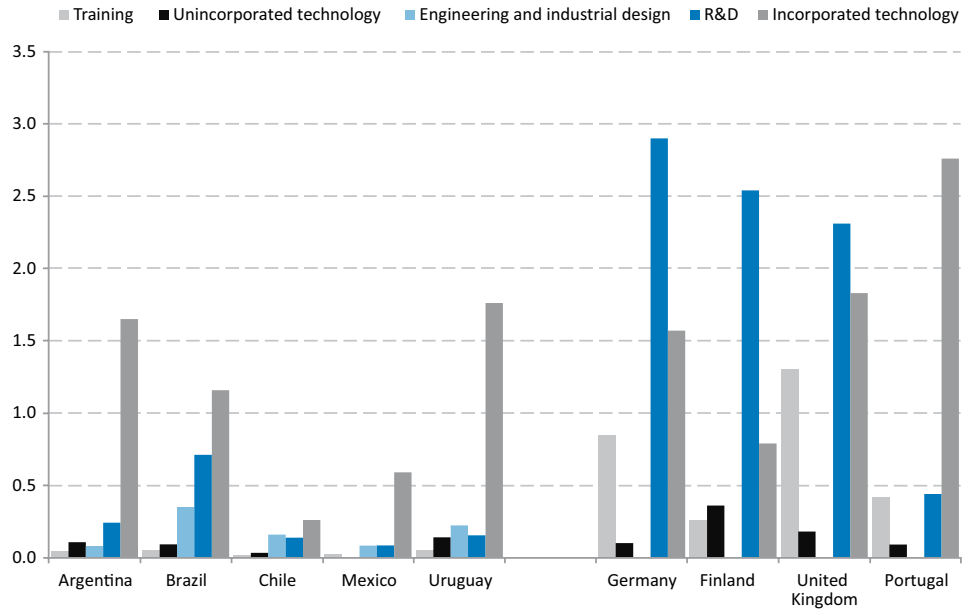
Latin American firms concentrate their scientific and technological activities in the acquisition of machinery and equipment, except for Brazilian firms that invest relatively more in R&D. This contrasts with OECD economies, where the business sector devotes a high percentage of its sales to R&D for expanding the stock of knowledge and developing new applications (see Figure 6.4). This explains the low level of density of linkages in innovation systems in the region. Innovation surveys indicate that there is little co-operation between businesses and scientific and technological research institutes. In Mexico only 4.5% of innovative firms collaborate with institutes on R&D projects, and in countries where this tendency is greater, such as Argentina and Uruguay, the percentage does not exceed 12% of firms.[7] This stems mainly from sectoral specialisation (with most companies in low-knowledge-intensity sectors) and the lack of a culture and incentives for greater collaboration between research institutes and the private sector. Access to markets is also an important factor for innovation. Business development programmes to support the exports of innovative firms are also crucial for creating an environment that encourages private-sector investment in innovation.

**Figure 6.4. Latin America and the Caribbean and the OECD: emphasis on innovation activities in manufacturing (% of sales), 2010**




*Note:* Based on the Bogota Manual (2001), incorporated technology includes capital goods (machinery and equipment) which involve technological change in the firm and which are linked to new products or processes, and hardware. Unincorporated technology refers to the licensing and transfer of technology (patents, trademarks, industrial secrets, etc.), consulting (for production, products, organization of the productive system, organization and management, finances, sales) and software. Engineering and industrial design (EID) include plans and drawings aimed at defining procedures, technical specifications and operative characteristics necessary for the production of new technological goods and the implementation of new processes.

*Source:* ECLAC/SEGIB (2010), Ibero-American Spaces. Links between Universities and Businesses for Technological Development, ECLAC, LC/G. 2478. Santiago de Chile. Based on National Innovation Surveys in Latin America (Argentina: 1998-2001, Brazil: 2001-03, Chile: 1998-01, Mexico: 1999-00; Uruguay: 2001-03) and Third Survey Innovation of the European Community (CIS3).
http://dx.doi.org/10.1787/888932523120

The innovation profile of firms in the region is mixed. There are important differences in the innovative behaviour of firms depending on size. SMEs in the region face greater barriers to innovation than large firms. According to national innovation surveys, smaller firms face higher obstacles, such as access to credit markets, reduced ability to diversify risks, problems of scale and barriers to exports. These obstacles reduce their ability to invest in innovation activities.[8] Public policies that eliminate or reduce the specific bottlenecks faced by SMEs are key to stimulating innovation in those firms.

*7)* Patenting in the region is low, but it is on the rise. Still, non-residents patent more than residents in Latin America. However, the countries of the region have increased the number of patent applications in international patent offices, but their performance falls short of the pace of Asian countries. For example, in 1995 Latin American and Caribbean countries registered 196 patents with the United States Patent and Trademark Office (USPTO), while Asian countries (excluding Japan) registered 3 545; in 2009, these numbers were 290 for Latin America and the Caribbean and 20 036 for Asia. At the same time, patent offices in Latin American countries have modernised and advanced in the provision of services and procedures. However, it is non-residents who most often apply for and obtain patents in these offices.[9] If countries in the region are to move forward in designing intellectual-property management systems, they need to support innovation and business development strategies in order to foster innovation.

This brief overview reveals a region that faces major challenges if it is to reach the level of competences and capacities necessary for success in the global knowledge economy. On the other hand, Latin America and the Caribbean is a region on the move, where important progress is being made, even though it is confined to certain sectors, regions or groups of businesses. At the same time, changes in world markets and new technological paradigms (ICTs, biotechnology, nanotechnology, new materials, etc.) are reshaping innovation and are increasing its complexity and forms. These new paradigms require significant investments in R&D as well as complementary activities (business and technology services, training, infrastructure, business development, etc.). Dialogue among businesses, universities, civil society and public-sector agencies is essential for designing better policy instruments and increasing financial resources to strengthen the impact of public action.

The landscape described above poses significant challenges for the state and requires transformations in public policy and institutional capacity to support innovation. Innovation policy is also expected to have short- and medium-term impact on competitiveness in world markets and job creation, creating additional pressure to prioritise innovation in government programmes and in public- and private-sector budgets.

Budget constraints and uncertainty in the dynamics of international markets require more effectively managed public policy, capable of responding to a constantly changing context. Greater transparency, efficiency and effectiveness can only be achieved if support is given to institutional learning in the design and implementation of public policies and investment is made in improved institutional capacities and new forms of governance to facilitate the co-ordination of public policies.

## 6.3. Modernising the State to promote innovation: what progress has been made in the region?

The countries of the region have made progress in modernising the state to promote innovation in four main areas: *i)* the introduction of public-policy models focused on strengthening national innovation systems; *ii)* new governance models for the design of strategies focused on generating spaces for negotiation and co-ordination between different levels of government (vertical and horizontal co-ordination); *iii)* new policy instruments, in particular the introduction of new financing mechanisms and support for technology transfer; and *iv)* strengthening institutional capacities at both technical and policy-management levels, such as through the creation of strategic intelligence units to define strategies and assess policy impact.

### 6.3.1. The evolution of policy models: From linear supply to innovation systems

In recent years, Latin American countries have gained experience and made progress in designing and —albeit less frequently— implementing policy. They have also introduced important institutional reforms for the management of innovation policies, although each country has done so at a different pace and with different levels of accomplishment.

The experience of Latin American countries in the design and implementation of innovation policies dates back to the 1950s (see Figure 6.1). In the first period, while there was not an explicit innovation policy, the State laid the foundations for scientific and technological development and for the institutional infrastructure for the management of future science and technology policies. During this period, research institutes and scientific advisory bodies were created to develop the region's

domestic scientific capacity in order to support national industrialisation strategies. The aim was to escape the peripheral condition of dependency through technical progress and institutions focused their innovation policies on supply and knowledge generation in sectors identified as strategic for national development.[10]

By the late 1980s, this model had reached its limit, and structural reforms introduced some changes, placing emphasis on trade liberalisation and export-led growth. During this period, public policy played a marginal role, and the main instruments were incentives aimed at demand to boost the private sector. Institutions were modernised and streamlined, and some were closed to avoid duplication of effort. Private-sector approaches to management were introduced, replacing those associated with the scientific world. In addition, some important complementary activities were reduced, such as the provision of rural extension services that facilitated the absorption of technological advances in local agricultural production, thereby reducing the impact of public research institutes and their ability to transfer knowledge to the productive world.[11]

In the most recent period, countries in the region have moved towards more sophisticated innovation policy models focused on the interactions between the scientific and productive sectors and on public-private partnerships for technology development. At first, the spread of the information and communications technologies (ICTs) paradigm absorbed much of the innovation agenda. Issues of access to ICTs and their use in the modernisation of the state, both for management within the public sector and in the provision of services, have been central to the strategies of various countries in the region. This has led to progress in public administration and in creating new and better approaches to public policy management. The institutions responsible for formulating innovation policies, as well as other government institutions, reformed their management in this period, allowing governments to become more open and communicate differently with users. This modernisation has in some cases led to an increase in the cost of managing public institutions because of royalty payments and information technology services. Furthermore, in contexts of high heterogeneity among actors in the system, the transition to e-government has widened the access gap between users based on their skills and location.

**Table 6.1. Main innovation policy models**

| | Linear supply model | Linear demand model | Public-private partnership model | Towards a new model? |
|---|---|---|---|---|
| Period and national development strategy | Industrialisation by import substitution | Washington Consensus, structural reforms, export-led growth model | Post–Washington Consensus and growth supported by the spread of new technological paradigms and led by export of natural resources | Phase of growing prices for natural resources and post-2008, search for new sources of growth, green economy and growing role of domestic demand |
| Innovation policy framework | Structuralist | Market failures | National innovation systems | Sectoral innovation systems |
| Underlying assumption | Public sector is principal provider of scientific knowledge | Private sector is motor for technological change and innovation | Recognition of the complementarity between public and private sector in the generation and dissemination of knowledge | |
| Sectoral focus | Yes | No | No | Yes |
| Pattern of knowledge dissemination | From top to bottom | From bottom to top | Two-way | Systemic |
| Main policy approaches | Centralised and selective policies in support of efforts to create a national manufacturing industry | Horizontal policies and incentive mechanisms aimed at demand<br><br>(absence of industrial policy) | Support for the generation of consortiums and networks for innovation and focus on technology transfer policies<br><br>(absence of industrial policy) | Incentives for innovation with involvement of the private sector and sectoral focus<br><br>(return of industrial policy) |
| Governance and management criteria for STI institutions | Centralised model oriented towards scientific research The scientific agenda and the academic sector predominate | Minimalist system and prevalence of market mechanisms and efficiency criteria | Modernisation of the management of institutions (rationalisation and modernisation), gradual transition towards systems of open and participatory management, development of mechanisms for collaboration between the public and private sectors | More sophisticated governance models for institutions, emphasis on mechanisms and incentives for dialogue among levels of government (horizontal and vertical) and between the public and private sectors |

*Source:* Primi (2011).

An important breakthrough in the past decade was the concept of a "national innovation system" as the framework for the design and implementation of innovation policies. This approach conceives innovation as a complex, non-linear and non-deterministic phenomenon that requires interaction among the different actors of the system (such as firms, universities and research centres, as well as the public institutions that establish the system of governance for incentives and collaboration among these actors).

This, in turn, requires a public-policy model that includes forms and incentives for collaboration and partnership between the public and private sectors, both at the level of strategy and funding. As a result, institutions responsible for innovation policy need new competences and new spaces for dialogue and consultation. This leads to finding common ground among different interests, such as those of academia, the business world and civil society.

At first, the innovation agenda resulted in a simplified version of the national innovation systems approach, focusing on designing instruments to support collaboration between public and private sectors on innovation. The return of sustained growth in the region, in part due to the rising costs of raw materials and natural resources, has helped to further the development of policy models for innovation, thanks to the existence of potential new sources of funding combined with the need to design policies to support competitive diversification. The use of revenues derived from exports of natural resources for the financing of innovation requires articulated governance models for allowing dialogue with the private sector and the regions where natural resources are found. At the same time, the increased availability of financial resources for innovation increases the pressure on "what to do" and "how to do it", requiring better and more transparent mechanisms for monitoring and evaluation.

Sustained and sustainable growth requires finding effective forms of interaction between the private and public sectors to support the introduction of new processes, new products, new business models and new ways of organising production. Innovation policies need to move towards models that support the generation of scientific and technological capabilities in frontier sectors; at the same time they need to promote the modernisation of production and the adoption of marginal innovations to improve the competitiveness of existing firms. These models require high institutional capacity at different levels of government for their implementation.

### 6.3.2. New governance models for strategy setting

There is high heterogeneity among countries in Latin America in regard to the institutional framework for innovation and its place in the government power structure. Only five countries have a Ministry of Innovation: Argentina, Brazil, Costa Rica, Cuba and the Bolivarian Republic of Venezuela. In other countries different models prevail: national innovation councils directly under the presidency, as in Chile and Nicaragua, for example; or national councils under different ministries (usually the ministry of industry or education), as in Mexico or Peru.

There are different institutional models, which vary in terms of level of complexity and frequency of contact among different actors. Brazil has the most complex institutional system. The Brazilian Ministry of Science and Technology has an influential and co-ordinating role in defining strategy and execution, together with the Ministry of Development, Industry and Foreign Trade and the Brazilian Development Bank (BNDES). In addition, various agencies are responsible for programme implementation and funding, such as the Brazilian Innovation Agency (FINEP), which offers funds for business innovation programmes, and the National Research Council (CNPq), which funds scientific R&D programmes. Brazil also has a well-articulated governance structure, albeit with significant differences across the country, in which across levels of government each State has its own foundation

for R&D support. Other countries in the region have simpler models, some more decentralised (e.g. Mexico) than others (e.g. Chile).

Beyond country differences, a common element is that innovation is a priority of the development agendas of almost all of the countries in the region, although its importance is reflected in the debates that take place than in increased levels of budgetary allocation. The greatest challenge is to design and implement innovation policies that on the one hand support structural change, the diversification of production and the creation of new sectors, and on the other hand promote the modernisation and competitiveness of traditional sectors.

In addition, some structural weaknesses continue to hinder the formulation of innovation policies and to hamper the transition towards more pragmatic and effective policy models. For innovation policy to be effective it needs real financial support. For example, recent advances in Uruguay in terms of institutionalisation and promotion of innovation have taken place thanks to the Ministry of Economy and Finance's support to the country's national innovation strategy.

Weaknesses in the design of policy instruments include: *i)* poor planning capacity and a tendency to allocate resources based on short-term evaluations, *ii)* little capacity to monitor and evaluate implemented programmes, *iii)* insufficient feedback mechanisms between design and implementation; and *iv)* an excessive focus on "inputs" (more R&D, more qualified human resources, etc.) rather than on expected outputs (growing number of export firms, more and better jobs, introduction of new production processes and/or services, etc.).

There has also been little synchronisation between productive development and innovation policy, although this trend has been changing in recent years in some countries, in part thanks to the introduction of sectoral funds in support of innovation.

In recent years, countries in the region have prioritised a series of reforms in the governance and management of innovation policy in order to strengthen the state's capacity to support innovation in the new global economic situation. Most countries have established new institutions and/or new governance models for the formulation of innovation strategies. For example, in Argentina, the establishment of the Ministry of Science, Technology and Productive Innovation in 2008 responded to the desire to promote productive development and innovation and to increase the collaboration between science and business. In Chile, the creation of the National Innovation Council for Competitiveness has been a major advance in enabling institutions, through the Committee of Ministers for Innovation, to make innovation a key issue in the government agenda.

The growing demand for the formulation of innovation strategies has created a need for new spaces for vertical and horizontal co-ordination. In fact, innovation is increasingly a cross-cutting issue in the agendas of different sectoral ministries (such as health, energy, the environment and education), beyond its traditional role for development in agriculture and manufacturing.

There is an increasing need for more co-ordination between different sectoral agendas (of the various ministries) to increase the effectiveness of public action. This also augments the complexity of managing innovation policies, since various visions and conceptualisations of innovation clash, requiring different public-policy tools. Brazil has responded to these challenges by creating co-ordination mechanisms between innovation policy and productive development policy. In this regard, the partnership between the Ministry of Science and Technology, Ministry of Development, Industry and Foreign Trade and the Brazilian Development Bank (BNDES) is a clear advance in institutional design. At the same time, in line with the recent national strategy for growth with social inclusion, the Ministry of Science and Technology has supported the strengthening of institutions in Brazil's federal states in order to promote production structure diversification and to increase the country's scientific, technological and productive strength.

### Box 6.1. New governance models for the formulation of strategies in the region: a brief review of the experiences of Argentina, Brazil, Chile and Mexico

**Argentina** stands out for its long history of public efforts supporting capacities in the field of scienceThese efforts go back to the early 1950s, when the country invested in the establishment of public research institutes, such as the National Commission for Atomic Energy (CNEA), the National Institute for Agricultural Technology (INTA), the National Institute for Industrial Technology (INTI), and the National Council for Scientific and Technological Research (CONICET). Recently, the country has invested in the creation of a new governance model for public policy. The measures taken to facilitate the articulation and vertical and horizontal co-ordination of policy include:

- The creation of the Ministry of Science, Technology and Productive Innovation (2008), which is responsible for formulating policies and programmes and for supervising the bodies responsible for the promotion, regulation and enforcement of policies (the National Agency for the Promotion of Science and Technology [ANPCyT] and CONICET).
- The creation of the Science and Technology Cabinet (GACTEC) and the Inter-Institutional Council for Science and Technology (CICyT) as policy–co-ordination bodies.
- The consolidation of the administration of scientific research grants (CONCYT) and business innovation (FONTAR) under a single agency.

In **Brazil** the National Science and Technology Council (CCT) is the body responsible for strategic formulation and co-ordination in the field of science, technology and innovation and reports directly to the President of the Republic. The CCT has the following tasks: proposing a science and technology policy for the country; developing plans, goals and priorities; conducting assessments; and issuing opinions on specific issues under their purview. The Council is composed of the government ministers responsible for this area, who represent the science and technology community (universities, institutes, regions) and business representatives. It is chaired by the President, and the Minister of Science and Technology is the Executive Secretary.

The Ministry of Science and Technology is in turn responsible for implementing the science and technology policy. The operating arms for the implementation of innovation policies are the National Council for Scientific and Technological Development (CNPq), aimed at developing scientific and technological research, especially through scholarships and grants, and the Financier of Studies and Projects (FINEP), which supports the science, technology and innovation actions of public and private institutions. Additional key players are: the Coordination for the Improvement of Higher-Level Personnel (CAPES), which supports post-graduate studies, and the Brazilian Development Bank (BNDES), linked to the Ministry of Development, Industry and Foreign Trade (MDIC), which provides long-term financing for projects that contribute to national development (including support for seed and venture capital initiatives and direct financing of innovation projects).

There are numerous state foundations and public technology institutes carrying out research and development activities and providing technology services, in addition to public enterprises carrying out research and development in frontier areas (Petrobras, Embrapa, etc.).

In **Chile**, the National Innovation Council for Competitiveness (CNIC), established in 2005, formulates medium-term strategy and counts on academic and business sectors in defining and accomplishing its mission.

Inter-sectoral co-ordination is ensured by the Committee of Ministers (CM), chaired by the Minister of Economy, and comprised of the ministers responsible for areas related to innovation, specialists and representatives of the private sector and academia. The CM administers the National Innovation Fund for Competitiveness (FIC), with royalties from copper mining, and contracts specialised agencies (CONICYT and CORFO, among others) for the implementation of priority programmes.

The system of policy governance that is evolving is based on two pillars: the Ministry of Economy (in charge of business innovation) and the Ministry of Education (in charge of higher education and basic research).

The creation of the CNIC and the CM has made it possible to move forward in the design of strategies and prioritisation mechanisms and create incentives for generating institutional capacities for analysis and evaluation of innovation policy. Progress has also been made in establishing, albeit tentatively, mechanisms for alignment between budget and expenditure on innovation, and in the design of instruments to support targeted rather than horizontal (clusters) innovation. The system still has a number of structural weaknesses that require institutional modernisation, including the CNIC's weak capacity to engage and generate commitments from the private sector and its poor alignment with the Ministry of Finance (Budget Office) in prioritising expenditures.

In **Mexico**, the National Council on Science and Technology (CONACYT) is an advisory body to the federal government specialising in the articulation of public policies by the federal government. It promotes research in science and technology, innovation and development, and the technological modernisation of the country.

CONACYT is the leading body for the strategic management of innovation policy. The Council has introduced sectoral funds to support innovation, highlighting its commitment to increase this support. The Council has a well-developed structure with offices in every state with experience in the mobilisation of local actors to promote business competitiveness. Its tasks include promoting basic and applied research, managing training programmes to develop qualified human resources and fostering productive innovation.

In Mexico, there are also state councils for science and technology, which work in collaboration with the federal level through the National Conference on Science and Technology. Mexico also has a group of research centres co-ordinated by CONACYT to add to the work conducted by public universities. This collaboration is further complemented by a group of providers of science and technology services, which also act as a link between companies and technology institutes (providing information, consulting and training), such as the Information and Documentation Fund for Industry (INFOTEC) and the National Processing Industry Chamber (Canacintra).

*Source:* OECD (2011).

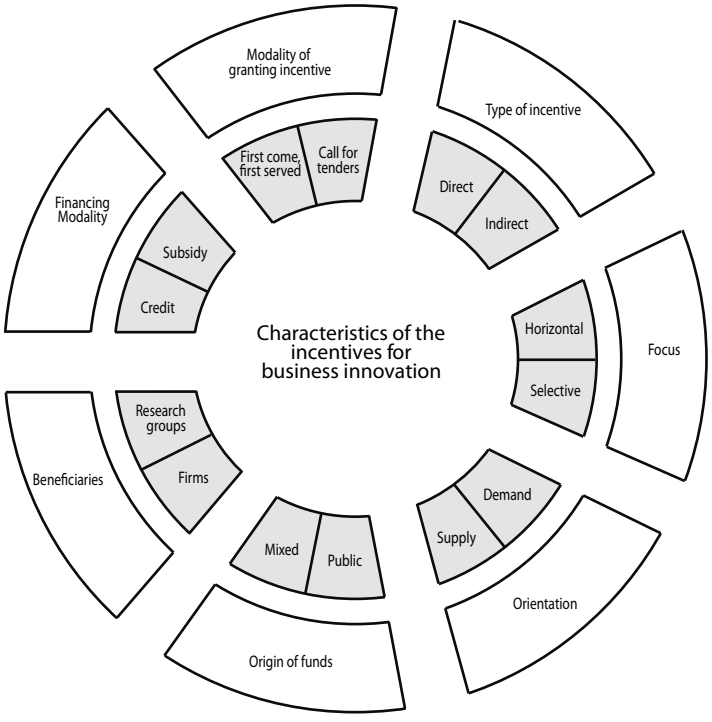
### 6.3.3. Introducing new instruments for innovation financing and for technology transfer

A key element in the implementation of innovation and productive development policies is the design of funding mechanisms. This is especially the case in countries where the private sector is largely unfamiliar with the importance of science, technology and innovation for increasing productivity and competitiveness and with rent-seeking traditions linked to the exploitation of natural resources.

A public policy that attempts to boost investment in research, development and innovation (RDI) needs to consider how to involve the private sector in this process, taking into account the major bottlenecks such as high uncertainty associated with investments in R&D; high interest rates; high costs; poor access to credit markets (especially for smaller companies); limited possibilities to develop ties with other companies, universities or research centres; and difficulties in market access and export development, etc.

The incentives for business investment in RDI can be classified based on various criteria (see Diagram 6.1). There are direct incentives (tax credits, non-reimbursable subsidies, subsidised credit, etc.) or indirect incentives (for technical human resources training; investment in public goods; business centres, incubators and parks; technological service centres; etc.). These, in turn, can be horizontal or selective (based on their capacity to distinguish beneficiaries by sector, company size, etc.).

**Diagram 6.1 Main features of innovation incentives for companies**




*Source:* Produced by authors
http://dx.doi.org/10.1787/888932523158

Incentives for innovation can be supply-side, in which case the public sector defines the stimuli designed to boost private-sector investment in research, development and innovation; or demand-side, which occurs when there is a public call for proposals, and the private sector proposes research and innovation projects.

The resources used to finance the innovation activities in firms can come from the public sector – whether through the reallocation of funds or multilateral loans – or from mixed funds generated through financing from the productive sector itself, as in the case of Chile's mining royalties or Brazil's sectoral funds. There are two main financing modalities: through loans or through grants and subsidies. There are many variants of both modalities. For example, loans can take the form of concessional or contingent loans, while grants or subsidies can come in the form of direct grants (such as non-repayable contributions, so-called "matching grants"), or indirect subsidies (such as funding for human resources training). As for how to provide and manage incentives, there are essentially two contrasting ways. One is through a first-come, first-served one-stop shop: if funds are limited, the first projects to be presented are more likely to be approved. The other is through public calls for tenders, in which there is a specific period of time to submit projects for evaluation and funding.

The experience of countries that have progressed in scientific and technological development shows that it is necessary to combine different financing instruments with different forms of credit, as well as with direct and indirect subsidies and tax incentives, to narrow the technology gap. An appropriate combination would provide support for the widespread modernisation of the productive sector and the inclusion of instruments to support firms that have greater financial limitations (such as SMEs), and promote the development of new priority sectors, which requires carrying out technology foresight activities.

There is no single optimal mix of incentives. The most appropriate mix of instruments will depend on the strategic and technological priorities of the country, the characteristics of its tax system,[12] the fiscal situation, its technical capacities, and whether there is an investment bank, among other factors. To increase the effectiveness of support for innovation activities and meet different needs, various instruments must be combined. One option is concessional loans, which finance projects with low technical risk, companies providing counterpart funds. Another option is direct subsidies (which may need to combine support from the state and the private sector), for financing projects for the development of new products and/or processes or the creation of R&D laboratories.[13] There are also fiscal incentives, such as the reduction of import tariffs and domestic taxes for the purchase of R&D laboratory equipment, delayed tax payment, and accelerated depreciation of R&D equipment to facilitate private investment in innovation. It is also important to support the further development of mechanisms for financing such as venture capital, which in general supports the creation of technology-based companies.

Rapid technological progress also involves designing and implementing innovative and flexible instruments to harness new opportunities, such as the BNDES Card introduced in 2003 in Brazil to facilitate investment in projects to improve competitiveness among micro and small enterprises (see Box 6.2).

### Box 6.2. The BNDES card, expanding access to credit

The BNDES card (Cartão BNDES) is a product that was created in 2003 by the Brazilian Development Bank. It offers credit to micro, small and medium-sized enterprises with a gross turnover of up to 90 billion Brazilian reais (BRL) (approximately USD 45 million in 2009) and national capital control, and it consists of revolving pre-approved credit.

It is an instrument intended to facilitate access to credit for market sectors that generally face problems with financing and access to credit for the purchase of specific products and services. These products and services must be previously registered with the BNDES (to be registered, products must have a minimum nationalisation index of 60%). This instrument currently provides financing for more than 125 000 registered goods and services, which can be categorised as follows:

- Machinery and equipment
- Medical, dental and hospital equipment
- A range of vehicles
- Heavy transport and cargo equipment and similar equipment
- Vehicle spare parts and tyres
- Inputs for various industry segments (metallurgy, textiles, furniture, leather and footwear, bakery, plastics, etc.)
- Information and telecommunications equipment
- Automation Equipment
- Technology and innovation services
- Software
- Furniture and accessories

The items that are financed include many goods and services to support technological modernisation and facilitate innovation and technical change. Purchase of these good and services also supports and strengthens the sectors producing them and strengthens ties between Brazilian companies.

The interest rate applied is more advantageous than market rates, whether for working capital or for the acquisition of goods. Besides the preferential interest rate, having an approved credit line (so that firms do not need to undergo credit analysis for each operation) reduces the transaction costs of financial transactions for both customers holding the card and financial institutions themselves.

For all the above reasons, the increase in the number and value of operations carried out using the BNDES Card has been significant. The success of the BNDES Card is reflected in the more than 63 000 operations carried out in 2008, an amount equivalent to BRL 934 million (approximately USD 467 million in 2008), representing an 60% increase compared to 2007. The card was thus responsible for the largest number of BNDES operations with micro, small and medium-sized enterprises.

*Source:* based on information from BNDES.

The return of sectoral innovation agendas has led to the creation of new funding mechanisms for innovation which allocate funds for innovation to specific productive sectors; this is the case of the sectoral funds in Brazil (see Box 6.3), Argentina and Mexico. This requires new institutional capacities for managing the complexity of collaboration between the private sector and public sector and the sectoral selectivity of policies. This also requires increased resources and stable sources of medium- and long-term funding.

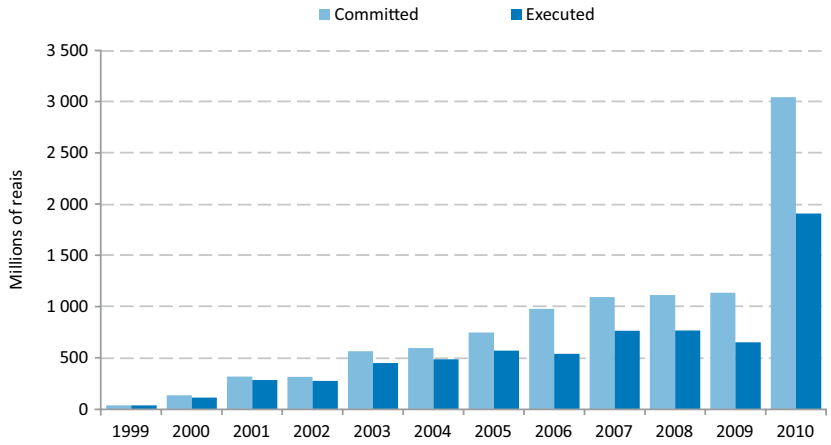
### Box 6.3. Sectoral funds in Brazil: ten years implementing a new model of financing and governance

The goverance structure and the articulation between different institutions are essential to determine the success of a policy. This is reflected in the scheme of the sectoral funds in Brazil, which focus on innovation and co-operation, with a steering committee formed by members from the Ministry of Science and Technology, sectoral ministries, regulatory agencies, the scientific community and the business sector. Through discussion and negotiation among steering committee members, key decisions regarding the allocation of resources are made. The public are aware of the success of sectoral funds, which support different sectors defined as strategic for the country. This system is considered among the main reasons for Brazil's recent rapid growth in science, technology and innovation (reaching levels of investment in R&D of around 1.2% of GDP in 2009).

The sectoral funds supporting science, technology and innovation activities in Brazil, are built on co-ordination between stakeholders and use sectoral revenue as a source of funding. They guarantee significant returns and promote co-participation among all stakeholders (companies, universities, governments and research institutions) in project planning and the administration of funds.

However, they also have intrinsic weaknesses, which may explain why there is still a low level of disbursement of allocated funds. One particular area of weakness is management and administration, due to the high level of complexity and the number of actors involved in steering committees, as well as the potential overlap of interests that may cause problems in co-ordination.

**Figure 6.5. Sectoral funds in Brazil, budget and execution, 1999-2010**




*Source:* ECLAC/SEGIB (2010), based on information of the Brazilian Ministry of Science, Technology and Innovation (http://www.mct.gov.br).

http://dx.doi.org/10.1787/888932523139

Since 2003, Latin America has been on a path of sustained economic growth with more dynamic trade, primarily due to the rising prices of raw materials (at least in South America). This has resulted in the generation of a surplus. Under the right schemes of governance and with a strong political commitment, this could become a source of substantial funding for policies to promote diversification and innovation. However, this requires a high level of governmental co-ordination to build consensus. The case of Chile's mining royalties is an interesting example of the process of designing an instrument to increase revenue to boost scientific and technological development and of reaching consensus in the area (Figure 6.4).

### Box 6.4. Chile's mining royalties: financing innovation through income from natural resources

The law regulating mining royalties was introduced in Chile in 2005 (Law 20 026). This legislation established a specific tax on mining, which was implemented based on the idea that Chile's regions needed extra funds to finance innovation projects to help diversify and boost their economies and to reduce the country's vulnerability to external shocks from rising and falling international copper prices.

The tax is on mining companies with annual sales exceeding 12 000 tonnes of fine copper and is paid in instalments and based on a mine's operating taxable income. For annual sales exceeding the value of 50 000 tonnes of fine copper, a single tax rate of 5% is applied. For annual sales between 12 000 and 50 000 tonnes, a tiered rate is applied, which can range from 0.5% to 4.5%, based on tonnage categories. Mine operators whose sales are 12 000 tonnes or below are exempt from paying the tax.

In parallel with the introduction of the mining royalty, the National Innovation Council for Competitiveness (CNIC) was established. This public-private body acts as a permanent advisor to the President of the Republic on public innovation and competitiveness policies, including scientific and technological development, training of human resources and innovative entrepreneurship. It also acts as a catalyst for important initiatives in these areas. In addition, it defines the country's innovation strategy, identifying the main lines of action to be financed with the funds from mining royalties.

The primary recipient of the royalty funds is the National Innovation Fund for Competitiveness (FIC), whose aim is to finance the promotion of science and technology, human capital formation and innovation in business, culture, institutional structures, infrastructure and regions. The FIC is the financing instrument of the executive branch with budgetary support for the implementation of national and regional innovation policies. These policies aim to strengthen the innovation system at the national and regional levels and provide transparency, flexibility and competitive and strategic direction to state action.

The creation of the FIC has led to a significant increase in the budget for innovation in Chile.[a] However, as is often the case in the early stages of new funds, budget execution has been low. The fact that the legislative process regarding the fund is itself ongoing makes it difficult to turn this resource into a permanent source of funding for innovation. The difficulties of managing these resources include the need to generate a consensus among regional governments, as royalties from the production of natural resources traditionally go to the community where mining takes place as compensation. The generation of adequate mechanisms for dialogue between government levels is critical to advance in the use of these resources as an additional source of funding for competitiveness.

*Source:* Based on information from the National Innovation Council for Competitiveness in Chile.

[a] OECD (2010b).

Given the complexity of innovation and technical change, it is not enough to design financial support mechanisms; it is also necessary to foment investment in collaboration and facilitate the flow and application of knowledge in productive systems.

The dynamics of innovation depends not only on the efforts of individual firms, research centres and universities, but also on the interaction among them and on the systemic capacity to create the conditions and incentives for innovation. In this context, public policies play a decisive role in supporting scientific and technological development and innovation, especially when productive specialisation is oriented towards natural resources or labour-intensive sectors with low technology content.[14]

Mechanisms to support technology transfer are essential, making it possible to identify not only the importance of the links among different institutions, but also the channels for the technology transfer and the types of instruments that facilitate the different types of relations among institutions. The forms, intensity and channels of interaction among universities and firms are diverse, and depend largely on the institutional structure of each country. In particular, the use of different channels for knowledge transfer depend on multiple factors, such as: *i)* the specificity of each industrial sector, *ii)* regional location, *iii)* the trajectories of the disciplines involved, *iv)* the duration of contracts, and *v)* the organisational flexibility of the university (i.e. faculty, research group or technology transfer offices) to reach agreements, consider the incentives and channel results towards alternative sources for research. The nature of the collaboration can facilitate the creation of social capital for the different disciplines and organisations, based on trust, interaction and learning for innovation.

Table 6.2 describes interaction channels between universities and firms. Beyond supporting the design of new and better policy instruments it is important to increase the institutional capacity to evaluate incentives and development programmes. Some elements to consider are: low administrative costs; flexibility (the ability to react to changing environmental conditions); impact (incentives should generate externalities, such as associative modes of action to support innovation); transparency (through public tenders, assistance in the formulation of projects, etc.); and additionality (incentives must expand private investment, not replace what companies could finance on their own). At the same time, it is important to take into account the existence of incentives to facilitate collaboration among different agencies and institutions involved in the design, management and administration of funds and incentives. This often determines success or failure in implementing a particular policy instrument.

**Table 6.2. Technology transfer: channels, types of relationships and experiences in the region**

| Type of inter-relationship | Channels for the transfer of knowledge | Policy instruments | Experiences in the region |
|---|---|---|---|
| Human-resource flows | Internships, student training, hiring of graduates | Human resources training<br><br>Access of firms to skilled human resources who enable them to generate competitive advantages | • Intel and Costa Rican universities (Costa Rica)<br>• Scientific and Technological Development Fund (FONDEF) (Chile)<br>• Funding for Innovation, Science and Technology (FINCyT) (Peru) |
| Informal contacts among professionals | Professional networks, exchange of information | Technical and professional training<br><br>Innovation fairs and prizes | • Eaton Trucks Corporation and Unicamp (Brazil)<br>• Innovation fairs (in Brazilian states, Peru, etc.)<br>• Design fairs (São Paulo, Buenos Aires) |
| Activities for the communication and dissemination of knowledge | Events, seminars, conferences, publications and co-publications | Funding for the spread of scientific-technical knowledge | • Science and Business Meeting on biotechnology with the participation of various institutions (Mexico) |
| Services | Consultancy services, technical assistance, use of teams | Diversification of sources of university financing<br><br>Develop and update capacities of researchers and firms in applied science and technology (use of equipment)<br><br>Solution of firms' specific problems | • Provision of technical services of the University of the Republic (UDELAR) and the Technical Laboratory of Uruguary (LATU)<br>• National Institute of Industrial Technology (INTI) (Argentina)<br>• National Industrial Learning Service (SENAI), Brazilian Support Service for Entrepreneurs' and Small Businesses (SEBRAE) (Brazil) |
| Joint projects | Co-operation in R&D, research contracts, exchange of researchers, formal work networks, science and technology parks | Financing of innovation consortiums<br><br>Venture capital<br><br>Support for research networks | • National Laboratory of Materials and Structural Models of the University of Costa Rica and the Ministry of Public Works and Transport (Costa Rica)<br>• IT district, Buenos Aires (Argentina)<br>• Caren Science and Technology Park of the University of Chile (Chile)<br>• Technology Park Foundation Paraíba (PaqTcPB) (Brasil) |
| Licensing | Technology transfer offices (TTOs) | Support for licensing and dissemination of technology<br><br>Business coaching services to update capacities in applied science and technology (use of equipment) of researchers<br><br>Platforms to co-ordinate specialised demands from firms and university training | • Inova Agency for Innovation of the University of Campinas (Brazil)<br>• Monterrey Technology Institute (Mexico) |
| Technology-based firms | Transfer of knowledge through the generation of firms from basic or applied research | Spin-offs, incubators, "hybrid" company-university actors | • Ami-tec and the University of Medellín (spin-off in Colombia)<br>• Bio Sidus (Argentina) |

*Source:* Primi and Rovira (2011b).

### 6.3.4. Strengthening innovation policy management capacities

Latin American countries are making progress in learning how to design and implement innovation policies. One of their main challenges is to strengthen capacities so that the policies work. Experience shows that not only is good policy design necessary, but it is also necessary to invest in building the capacity to manage and implement programmes at all levels of government, especially when introducing new public policy measures.

The challenges faced by Latin American countries include: correcting failures in co-ordination, reducing overlap in policies, strengthening consistency over time and developing a sound decision-making structure for productive development and innovation policies, and strengthening the management and evaluation capabilities of policies. All of this requires highly skilled and experienced policy makers.

In this respect, there are three areas in which the countries of the region have made progress.

*1)* First of all, the region is investing in new and better management capacities for programme implementation and management of policy instruments.

Building and strengthening institutions and the domestic capabilities needed to design, implement and evaluate policies for productive development and innovation is a process of trial and error, requiring time, resources and a long-term perspective. In particular, the success or failure of policies and instruments implemented to achieve a more productive and innovative system is strongly conditioned by the abilities of those responsible for the design and management of the policies themselves.

Efforts have been made in the region to promote the training and specialisation of technical specialists experienced in developing and implementing science, technology and innovation who can design new instruments and to design new instruments and monitor the implementation of existing ones. One interesting capacity-building experience at the sub-national level is RENAPI (National Network for Industrial Policy Agents), which promotes training in regional industrial policy in Brazil. RENAPI is an initiative of the Brazilian Agency for Industrial Development (ABDI) and consists of a network of experts and officials in charge of industrial policy. Its aim is to promote the regionalisation of productive development policy. The network helps create a common language among participants by supporting the training of officials from around the country who are responsible for industrial policy and R&D.

Another example is the School for Policy Makers in Science, Technology and Innovation inaugurated in 2008 by ECLAC, with support from the German Co-operation Agency and various ministries and agencies responsible for science, technology and innovation in the region. Its main objective is the training of professionals involved in the development, monitoring, evaluation and implementation of science, technology and innovation policies. In this way it will contribute to strengthening the capacities of countries in the region in this field, the transfer of knowledge and experiences and the strengthening of their relations, as well as the identification of joint activities.[15]

*2)* Countries in the region are advancing in the creation of a regional space for policy discussion to address common challenges and advance in policy learning.

The consolidation of a regional mechanism for policy dialogue responds to the need to advance policy learning and to improve the position of the region in the global economy. It is also a response to the increasing pressure on policy makers to demonstrate the validity and effectiveness of policy measures proposed in a context of major budget constraints and greater transparency in public decision-making. In fact, the exchange and regular evaluation of practices and incentives among peers favours greater accountability in policy-making.

In Latin America there are several experiences in regional scientific collaboration. However, it is necessary to create permanent institutional mechanisms that support co-operation on policy and dialogue and make it viable. The diversity and complementarity among the capabilities and characteristics of the countries in the region represent an advantage for the creation of joint research and training programmes. In addition, the desire to create effective mechanisms for scientific collaboration results from the desire to increase synergies and overcome national boundaries, given the limits of human and financial resources available for scientific research.

A large number of collaborative initiatives and policy dialogues on innovation have taken place in the region, but they lack co-ordination and would benefit synergies were created among them. The panorama of collaborative activities on science, technology and innovation in Latin America is varied. We can identify at least three complementary levels for policy dialogue:

— The ministerial level (or the highest authorities), which defines strategic lines for international collaboration;

— The technical advisory level, which involves meetings with senior advisers of the highest authorities and generally focuses on dialogues related to policy "tactics", such as the design of mechanisms and incentives for science, technology and innovation.

— The policy implementation level, which refers to the dialogue among managers of programmes and policy instruments, aimed at exchanging practices and experiences in the policy implementation phase.

*3)* Thirdly, the region has advanced in measuring innovation and on strengthening strategic intelligence capacities for policy analysis and monitoring.

There are three major areas in which the countries of the region are advancing and modernising their institutions for decision-making in innovation policy:

— The generation of systems of indicators for decision-making: several countries have invested in establishing units engaged in the collection and dissemination of innovation indicators within national ministries or national secretaries for innovation. This advance is also supported by a vast modernisation of the information systems of ministries and higher bodies in science and technology, which has increased transparency and accessibility to data. This development has taken place in large countries like Argentina and Brazil, as well as in smaller countries such as Costa Rica and Panama.

— Innovation surveys: Latin America is consolidating its experience in the development of innovation surveys.[16] Like in OECD economies, innovation surveys are useful tools to deepen the understanding of innovative behaviour in firms, to assess obstacles to investment in innovation, and to determine the impact of public policies. However, unlike in OECD economies, the comparability of innovation surveys in the region must be improved. This process requires time and investment in institution building and dialogue among policy makers, experts and statistics institutes. Comparability between surveys is not simple and requires serious efforts at harmonisation.[17]

  In Latin America, this is even more complex because the surveys follow different models (in Brazil, Chile and Mexico they are based on the Oslo Manual, while in Argentina, Colombia and Uruguay they follow the Bogota Manual). Being a recent phenomenon in the region, only a few countries regularly conduct these surveys and use them for feedback on policies.[18] Comparability between them is still low. Specifically, only Argentina, Brazil, Chile, Colombia and Uruguay carry out surveys regularly, while Mexico does so sporadically, and Costa Rica, Panama, Peru and the Bolivarian Republic of Venezuela are just joining the effort.

— Creating and/or strengthening institutions for data analysis and decision-making: Investing in building data analysis capabilities to aid decision-making is important. It is also necessary to create incentives for the use of data analysis in evaluating and redesigning public policy. Unlike in OECD economies, Latin American countries are still at an early stage in the creation of institutions for policy analysis. The country that has made the most progress in this area is Brazil, where the Institute of Applied Economic Research (IPEA), affiliated to the Strategic Affairs Secretariat of the Presidency of the Republic, and the Centre for Management and Strategic Studies (CGEE), affiliated to the Ministry of Science and Technology, provide analysis and feedback on the implementation and impact of public policy.

## 6.4. Better governance for better policy

In summary, in the past decade the agenda for productive development and innovation has been given new impetus in the countries of Latin America. Today innovation plays a central role in the development agenda in almost all of the countries in the region, although its importance is more often reflected in debates and speeches rather than in increased levels of budgetary allocation.

The current global and regional economic trends are creating growing expectations regarding the need for medium-term impact of innovation policies on growth and competitiveness in global markets and on the capacity to strengthen domestic markets by generating more and better jobs.

Renewed interest in innovation places new pressure on governments to develop and implement more effective innovation strategies that can mobilise the business sector, especially in a context of high uncertainty regarding the dynamics of global markets. In addition, more effective and transparent management of the public system to support innovation is required for countries facing tight budgetary restrictions, as well as for those currently enjoying a period of high growth based on increasing exports of natural resources at high prices.

Diagnosis of productive development and innovation in Latin America makes it clear that the region needs to move forward in four areas:

*1)* Invest to close the productivity gap.

*2)* Raise investment in science and technology and R&D activities.

*3)* Increase the private sector's commitment to innovation and productive development.

*4)* Reduce the mismatch between supply and demand of skilled human resources.

This requires new models for public-policy governance capable of articulating actions and fostering agreements for investment in innovation. Institutions need to be stronger and public policy models more sophisticated; they must be capable of mobilising the different stakeholders in national innovation systems and all levels of government. This is particularly true in the Latin American context, with productive specialisation in low-knowledge-intensive sectors, high uncertainty and barriers to access to credit. Public policies therefore play a decisive role in generating incentives for investment in science and technology activities and for competitiveness based on added value and innovation.

In recent years, the countries of Latin America have made great strides in policy learning and have introduced significant reforms in innovation policies. Although there is still great heterogeneity in institutions and in governance models in the region, we can identify some common trends.

Among the advances are: strengthening the institutional framework for innovation (Argentina, Chile, Uruguay); creating and consolidating new funding models for innovation (Brazil, Chile, Colombia, Mexico); greater synchronisation between supporting innovation and developing strategic productive sectors (Argentina, Brazil, Chile, Mexico, Panama, Uruguay); growing attention to the territorial impact of innovation strategies, especially in relatively larger countries (Argentina, Brazil, Colombia) and improved institutional capacity to measure and assess the dynamics of innovation and the impact of public policies (Argentina, Brazil).

To overcome its structural weaknesses in innovation and in its capacity to support the development of production and technology, governments need to develop better governance models, which should be able to align actions and create synergies between different programmes and levels of government. To do this, the region must:

— Consolidate the synchronisation between innovation strategies and productive development by increasing the capacity to articulate programmes for sectoral and value-chain development. This requires governance mechanisms that promote dialogue among the ministries of economy and finance, trade and industry and innovation. It also requires financing mechanisms with a sectoral approach and the participation of all the stakeholders in the national innovation system (universities, businesses and civil society) in defining priorities. Innovation policy must also be synchronised with policies to support productive development to ensure more effective action and greater impact.

— Strengthen the capacity to develop innovation strategies. States must improve vertical co-ordination (between different levels of government) and horizontal co-ordination (between the different ministries responsible for different areas of innovation such as industry, agriculture, health, education, infrastructure, etc.) for defining priorities. There must also be greater private-sector participation in innovation.

— Increase resource-allocation capacity through multi-year plans to facilitate investment in medium- and long-term projects, and in parallel, increase the financial and business sectors' commitment to innovation. This requires investing in strategic intelligence in public administration and creating spaces for dialogue to establish trust mechanisms while increasing the state's regulatory capacity in the area.

— Evolve towards outcome-oriented policy models, designing policies that target outputs (more and better jobs and greater competitiveness) and consider inputs (such as R&D spending and human resources training) to be the means to achieving the strategic objectives.

— Strengthen the capacity to measure innovation. Investment is needed to create institutional spaces and feedback mechanisms between policy design and implementation in order to improve the capacity of policy makers to define and implement new, more sophisticated instruments. It is important to invest in the generation of innovation indicators and to create incentives for the use of information in policy assessment.

— Invest in the training of human resources responsible for managing policy on innovation and productive development and promote regional dialogue to exchange experiences and develop greater knowledge on innovation policy design and implementation. The innovation challenge for Latin America needs each country to have its own development agenda based on its specific production, historical and cultural characteristics. But it also requires a regional agenda in order to achieve the critical mass required in certain areas of knowledge and production for its successful integration into an increasingly competitive and dynamic global economy.

## Notes

1. OECD (1997); ECLAC (2004).
2. ECLAC (2010a).
3. ECLAC (2010a).
4. ECLAC (2008).
5. ECLAC (2010a).
6. The figures refer to 2008, the last year for which data is available from the source used, the United Nations Commodity Trade Statistics Database (COMTRADE) [http://comtrade.un.org].
7. Primi and Rovira (2011a).
8. López and Orliki (2006).
9. According to data from the national patent offices, in the countries of Latin America and the Caribbean approximately 90% of patent applications are filed by foreigners, while in more developed countries, it is national actors who are most active in terms of patenting (ECLAC, 2010b).
10. ECLAC (2004).
11. The case of Brazil and the impact of the closure of agricultural extension centres on the performance of Embrapa illustrates the adverse affects of some rationalisation measures.
12. For example, direct subsidies can be an option in a context where fiscal pressure is low and tax breaks are not foreseen for R&D activities.
13. Another distinctive characteristic of this type of incentive is that it can be used for horizontal as well as targeted policies, and it encourages collaboration between firms and public R&D organisations.
14. ECLAC (2004); Cimoli, Ferraz and Primi (2005).
15. In particular, the atmosphere of exchange in the School has fostered the development of proposals and projects for bilateral or multilateral technical co-operation, which have involved various institutions.
16. Cimoli, Primi and Rovira (2011).
17. OECD (2009b).
18. Primi and Rovira (2011a).

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