Chapter 3

The Role of Government

This chapter first briefly reviews the evolution of Mexico's S&T and innovation policy over the last four decades, describes and assesses recent policy initiatives concerning the institutional framework and the support programmes, and proposes some strategic orientations to improve the efficiency of policy design and delivery and achieve higher innovation performance by the Mexican economy.

The Mexican government has been slow to develop a comprehensive innovation system with a set of institutions and support policies explicitly designed to strengthen the country's scientific base, foster the innovative capacity and competitiveness of its productive sector, and better articulate the relationships between public research and industry.

As in other large Latin American countries, institution building started – often with the support of international organisations such as the Inter-American Development Bank – with the consolidation of research capacities in the academic sector, the promotion of human capital in S&T and the creation, under the aegis of sectoral ministries, of public research and technology centres entrusted with missions of knowledge creation and dissemination in areas related to social challenges, the development of natural resources and the improvement of competitiveness in import-substitution industries. The relative strength of the public research system favoured a linear view of innovation based on "S&T push". This view underpinned the mission entrusted to the National Council on Science and Technology (CONACYT), created in 1970 as an agency mainly responsible for the allocation of funding to the public research sector and the promotion of highly skilled human resources. Meanwhile, other government agencies were independently funding and managing support programmes to promote industrial development; these included instruments to upgrade the technological capacities of domestic private enterprises. These programmes were designed and implemented without much interaction with CONACYT.

Then, and particularly after the 1982 crisis which paved the way to the opening of the Mexican economy, government initiatives to shape the S&T and innovation system were influenced by the interplay of the main stakeholders: *i)* the academic community, whose main concerns remained the priority given to its two basic missions, the development of knowledge and the formation of skilled human capital, and the safeguard of its autonomy; *ii)* the enterprise sector – notably large enterprises including foreign affiliates – which claimed an increasing part of the S&T budget for technological capacity building and support to investment in private R&D and innovative activities; and *iii)* the variety of

ministries or government bodies wishing to maintain their responsibilities over the funding and management of policies and programmes in support of S&T activities in academia, sectoral public research centres and the productive sector. Given the scarcity of public resources, this led to the dispersion of resources and the fragmentation of programmes and a lack of mutual leverage between knowledge creation and demand for knowledge for innovative applications. This situation has left Mexico in a "low-level equilibrium trap" without positive feedback between scientific push and innovation pull effects ((Dutrenit *et al.,* 2008; Casas, 2006).

Since the middle of the 1990s the notion of a comprehensive national S&T and innovation system and the critical role of science-industry interactions in knowledge creation, dissemination and application have entered public debate. The importance of strengthening synergies between the supply and demand of knowledge began to gain ground at a conceptual level (OECD, 1994), but its translation into effective institutional changes and modes of governance, budgetary appropriations, and well-adapted support programmes and incentives failed to materialise successfully owing to low political commitment at the highest level of government, administrative inertia and stagnant public resources.

The first noteworthy efforts to develop a comprehensive and coherent S&T and innovation system came with the adoption of the 1999 S&T Law, which was revised in 2002, the change of status of CONACYT, and the adoption of the Special Programme for Science and Technology 2001-06 (PECYT) with newly designed support instruments. However, the PECYT did not fulfil its ambitious objectives. It is to be hoped that the newly adopted Special Programme for Science, Technology and Innovation 2008-12 (PECITI), adopted in September 2008 (CONACYT, 2008), along with the budgetary increases and the institutional and policy reforms that should accompany it, following recommendations made in this report, will prove more successful in improving the performance of Mexico's S&T and innovation (STI) system.

3.1. The evolution of Mexico's S&T and innovation policies

3.1.1. The initial phases prior to the creation of CONACYT

Aside from the National University of Mexico, founded in 1910, government efforts to promote institutions devoted to the development of scientific and technological capacity, mainly in the higher education sector, or the technological upgrading of enterprises began in the mid-1930s under President Lázaro Cárdenas.

The National Polytechnic Institute (IPN) was created in 1936 with the explicit dual mission of carrying out applied research and training of highly skilled professionals for industry.[1] Over the next three decades many sectoral public research institutes were established in areas such as health, agriculture and mining. The Centre of Research and Advanced Studies (CINVESTAV), an autonomous world-class advanced scientific teaching institution, was founded in 1961. It has increasingly engaged in S&T activities designed to contribute to the solution of national strategic problems.

Up to the creation of CONACYT in 1970 there were almost no established policies or programmes providing direct or indirect financial support for R&D and innovation activities in the business sector. Business investment in R&D and innovation activities was essentially undertaken by a few large public or private enterprises (domestic and foreign) in sectors such as steel, automotive, chemicals and cement. By and large, the

only support to the enterprise sector's technological development was provided on an *ad hoc* basis by public financial institutions such as the National Development Bank (NAFIN) or the Mexican Bank of Foreign Trade.

3.1.2. From the creation of CONACYT to the 1982 crisis

The main reason for the creation of CONACYT under the Ministry of Planning and Budget (SPP) was not the emergence of a new rationale for the government's role in the promotion of S&T and innovation relating to perceived market or systemic failures. The scientific community played an active role in its creation, which explains its academic orientation. Putting the CONACYT under the SPP was seen as insurance against budgetary fluctuations and constituted an attempt to subordinate the support provided by the state to the two main pillars of S&T capacity building (strengthening of public S&T institutions and formation of human capital) to the planning and budgeting logic that prevailed at the time.[2]

Indeed, in its beginnings, CONACYT's main instruments were the postgraduate scholarship programme and programmes for the development of the exact, natural and social sciences in public research institutions. Through CONACYT, new institutions were created, such as the Mexican Petroleum Institute (IMP) and the Electrical Research Institute (IIE) in connection with public enterprises in the energy sector. During that period, which was marked by strong state intervention and the major role of the scientific community in shaping CONACYT's action, new public higher education institutions were created both at the federal and state levels.[3]

3.1.3. The first transition period after the 1982 crisis to the end of the 1990s

During the following period Mexico's STI policy was characterised by important changes prompted by the 1982 crisis and the subsequent opening of the Mexican economy, as well as by the gradual emergence of new views of the role of government in supporting S&T capacity building in both research institutions and the productive sector.

First, in the successive national programmes for S&T development prepared during the period[4] the policy emphasis on promotion of technology and innovation gradually increased. This reflected the realisation that the Mexican economy's international competitiveness depended in part on the technological capacity of the productive sector and technology transfer mechanisms. However, this increased emphasis was not yet part of a systemic vision encompassing both the production of knowledge and its diffusion and application or of a comprehensive framework for policy design and implementation. Moreover, the dispersion of responsibilities for public research institutions among several ministries or agencies[5] and the lack of efficient governance mechanisms hindered a co-ordinated approach to the design, financing and implementation of STI policy.

Then, in the 1990s, it was recognised that the market and systemic failures that stopped industry from developing technology and innovative capabilities could be the object of specific support policies. Special programmes and new regulations therefore aimed at encouraging private R&D and innovation: examples include the Fund for R&D and Technological Modernization (FIDETEC), which later became the Programme to Support the Technological Modernization of Industry (PROMTEC); and the Fund for Strengthening Scientific and Technological Capacities (FORCCYTEC). CONACYT also created a special programme to promote academic-industry links (PREAEM) and the Incubator Programme for Technology-based Enterprises (PIEBT).[6] In addition the

government introduced several regulatory changes intended as incentives for innovation and technology transfer in industry. The law on patents and trademarks was modified to protect industrial property rights for a longer period, and quality standards and metrology were updated. The government promoted foreign direct investment (FDI) and free trade agreements to accelerate industry's technological modernisation. This evolution suggests that the S&T push model was beginning to be balanced by more emphasis on "demand-pull" policies.

At the beginning of the period, in 1984, the Mexican National System of Researchers (SNI) was established to mitigate the effects of researchers' worsening remuneration and working conditions following the 1982 crisis and the increasing risks of brain drain. It has played a very positive role in the constitution and development of a community of qualified researchers, who are selected, promoted and rewarded with non-taxable complements to their remuneration according to criteria based on the volume and excellence of their scientific production, essentially peer-reviewed scientific publications. Without this system, centrally managed by CONACYT and financed on its budget, the level of excellence of Mexico's research activities and the number and diversity of its internationally recognised researchers would not be what they are today. At the same time, the integration of academic personnel into the system and the number of SNI researchers among them became a main component of the evaluation of postgraduate studies programmes, higher education institutions and public research centres. The SNI has remained basically unchanged for more than two decades.[7] This system presently absorbs a significant part of CONACYT's budget. As will be seen below it requires further reforms.

In brief, this period was marked by important changes that affected supply and demand: on the one hand, the consolidation of the scientific workforce through the establishment of the SNI and the extension of the scholarship programme; and, on the other, the fostering of the innovative capacities of enterprises. However, this did not allow Mexico's STI system to escape the "low-level equilibrium trap". Linkages between the research and enterprise sectors remained poor, the governance of the overall system was extremely feeble, notably as regards its capacity to define priority orientations, facilitate consensus among stakeholders and ensure policy co-ordination, and budgetary efforts to promote S&T investment were weak (OECD, 1994).

3.1.4. Moving towards a comprehensive S&T and innovation policy: a second transition in progress

The second transition started at the end of the 1990s with the enacting of the first S&T Law in 1999, followed by the approval of the PECYT, and the amended S&T Law in 2002. It has seen major initiatives aimed at improving the design and implementation of Mexico's STI policy.

At the conceptual level, the PECYT explicitly recognised the complementarity and synergies between the demand and supply approach to S&T policies and the need for a systemic and comprehensive framework for such policies. This implied changes in the policy mix to put more emphasis on support to innovation and industry/science linkages, more rapid formation of human resources for S&T in basic and applied research, and a strengthening of the S&T infrastructure.

At the political level there appeared to be a consensus to substantially increase resources, notably budgetary, for science and technology. The 2002 S&T Law set a target for R&D expenditures of 1% of GDP by 2006, with a growing share financed by industry. It was also recognised that to ensure greater stability, S&T policy should be disconnected from Mexico's six-year political cycle. Greater attention was given to regional aspects of S&T policy through co-operation mechanisms between the federal and state levels in the definition, financing and implementation of S&T capacity building and R&D projects.

At the institutional level CONACYT attempted, with mixed success, to strengthen its co-ordination of various ministerial departments and agencies involved in STI policy. In the framework of the Organic Law of 2002, CONACYT obtained direct access to the newly created Council of Scientific Research and Technological Development chaired by the President of the Republic.[8] An Advisory Forum for Science and Technology (FCCyT) was established by the 2002 S&T Law to ensure the involvement of scientific and business stakeholders in the policy making process and to facilitate consensus building.

At the programmatic level efforts were made to better define medium- to long-term S&T strategic orientations in line with the 2001-06 National Development Plan priorities and to revamp support instruments for R&D and innovation. The PECYT pointed out the need to define and channel increased support to STI activities in the fields with the largest potential contribution to sustainable development and identified strategic priority sectors in which sustained public investment in S&T could lead to innovation-based growth and competitiveness and/or better satisfy collective needs.

Various funds were established to provide direct support to priority projects jointly defined and financed by CONACYT and sectoral ministries (sectoral funds) or by CONACYT and federal states (mixed funds). With the support of Congress, an R&D tax incentive was established in 2001 to foster private investment in R&D and innovation activities. Several support programmes were designed with explicit allocation criteria which favoured linkages between industry and research institutions.

However, in terms of implementation these initiatives proved much less effective than anticipated owing, among other things, to the low level of resources for S&T policy and individual support programmes[9] and the dilution of priorities, as a defective co-ordination among funding departments led to a fragmentation of programmes and bureaucratic procedures in their management and implementation.[10] In fact CONACYT experienced difficulties in assuming its inter-ministerial co-ordinating role in priority setting and resource allocation.

The transition initiated by the PECYT is therefore still under way. Taking stock of the PECYT's diagnosis of the weaknesses of the STI system but also of its limited progress in improving the system's performance, the Mexican government, at the beginning of the present administration, undertook a critical assessment of past policies with a view to addressing more effectively the chronic weaknesses of the system.[11] The preparation of the new Special Programme for Science, Technology and Innovation (PECITI), approved in September 2008, as well as the new STI law benefited from the results of this assessment process.

3.2. Institutional setting and governance

Legislative and regulatory initiatives implemented between 1999 and 2006 helped to shape the current institutional setting and governance of Mexico's STI system. They create a complex set of rules and decision-making processes that influence the interactions among the actors of the system, in the federal and state government, in public research institutions and the business sector. The tensions between the institutional architecture, with formal rules that must be followed, and the actual governance of the system reflect a balance of power among the actors that can give rise to inefficiencies and high transaction costs.

3.2.1. Recent institutional and regulatory initiatives

The main institutional initiatives concern CONACYT's Organic Law and the 2002 S&T Law and the regulatory measures related to its application. These measures include:

- the guidelines and legal, administrative and economic instruments in support of scientific and technological research included in the S&T Law and other applicable regulations;
- the procedures for the negotiation, co-ordination, participation and linkages defined by the S&T Law (2002) and other applicable regulations;
- the rules and norms governing S&T activities in higher education institutions (HEIs).

In 2005 and 2006, the public research centres (PRCs) were granted greater management autonomy regarding capability to manage their budgets, engage in contractual agreements with public and private firms to provide services or to perform joint technological development projects, and use the revenue from such contracts for their own investment in S&T infrastructure. However, they were given less autonomy for the management of human resources and for participation in the creation of spin-offs.[12]

The legal changes allow the PRCs' governing organisms to establish the conditions of appropriation and use of the results generated by their researchers, and to set rules of confidentiality when profitable knowledge is generated by joint PRC/industry projects or technology-based firms created by PRCs.[13] However, no clear rules or guidelines govern the sharing of the proceeds of the sale of intellectual property rights (IPRs) or licensing between PRCs, research groups and enterprises.

Staff researchers of PRCs and universities are civil servants and as such their conditions of employment, remuneration and pensions are governed by the relevant federal labour laws pertaining to public servants. This may entail rigidities in the management of human resources in public research institutions. As will be seen, it has also some perverse effects on the links between the management of the SNI and the age structure of researchers as SNI compensations cannot be included in pensions.

3.2.2. Governance

The government body ultimately responsible for the design and implementation of STI policy is the General Council for Scientific Research and Technological Development chaired by the President of the Republic. The Council includes the Minister of Finance, eight sectoral ministers with budgets for S&T programmes[14] and four members of the FCCyT invited by the President. CONACYT's director general is a member of the Council and acts as its executive secretary. While the Council should have an important role in defining strategic policy orientations, in inter-ministerial policy co-ordination and in the allocation of budgetary appropriations in the S&T area, this role has remained largely formal. Since its creation the Council has met no more than six times, in particular to formally approve the successive S&T plans.

CONACYT has, in principle, the authority to ensure inter-ministerial co-ordination of the design, financing and implementation of S&T policy, but, in practice, many factors hinder this. First, there is the question of its institutional status in the government structure.[15] The director general of CONACYT is not a member of the government and does not have real authority for policy co-ordination and even less for the allocation of budgetary appropriations. Moreover, CONACYT is governed by a Board chaired by a government minister.[16] Second, CONACYT's S&T budget is less than a third of the overall S&T budget[17] and the financing of many of the programmes it manages depends on the participation of sectoral funds of various ministries. Given CONACYT's institutional weakness in terms of policy co-ordination and the consequences in terms of budgetary allocation, two inter-ministerial committees assume these functions. The Inter-ministerial Budget Committee, under the Ministry of Finance, reviews the financing requirements of the ministries and agencies responsible for the implementation of STI support programmes and integrates them in the annual budget plan, *de facto* operating arbitrations among requirements. The Inter-sectoral and Linking Committee reviews and promotes proposals to create programmes involving several ministries and/or agencies; it can also propose agreements and specific support programmes involving co-operation between the federal and state or local governments.

The Advisory Forum for Science and Technology (FCCyT) was established by a government initiative in 2002 under the S&T Law. It is an independent civil organisation with its own budget. Its mission is to advise the President, the General Council for Scientific Research and Technological Development, CONACYT'S Board, and Congress. The Forum has a Board composed of 19 members representing academic and business institutions as well as government agencies involved in S&T policy and has a number of specialised committees. While the Forum has produced or commissioned studies or assessments of quality and relevance, its advisory role has not been as effective as that of S&T Councils composed of similar stakeholders in other countries, such as the Nordic countries or Chile, in defining a national STI strategy and priority actions. Its large membership (including the members of specialised committees) and the fact that its Board is composed of representatives of institutions rather than independent individuals probably explains why the Forum has found it difficult to forge a consensus among stakeholders regarding the orientations of S&T policy and the legislation or policy instruments needed to implement it.

The growing emphasis on decentralisation of STI policy and the strengthening of STI capacity at regional level has led to the establishment or development of decentralised and local government institutions. CONACYT has six regional offices, each of which is in charge of several federal states, all of which have established S&T councils. The regional offices and the S&T councils select S&T-related projects (including infrastructure). Their implementation is jointly funded by CONACYT and the federal states. The National Conference of Science and Technology was established by the 2002 S&T Law to address issues regarding collaboration between the state and federal level of governments on issues of policy priority and the design and implementation of support programmes. Chaired by the director general of CONACYT, it includes representatives of all state bodies with STI responsibilities.

This overview of the institutional setting and governance of Mexico's STI system highlights the fact that there is no real separation of the functions of policy design and of delivery in terms of financing and implementation. Ministries involved in the promotion of STI activities and CONACYT assume both functions either alone or in collaboration. This situation, compounded by inefficient co-ordination procedures and weak evaluation practices, underscores the need to improve the governance of Mexico's STI policy. Recommendations concerning possible paths for improvement are developed at the end of the chapter.

3.3. Financing, priority setting and policy mix

3.3.1. Financing of STI policy and resource allocation

The S&T regulations introduced by the government in 2002 created a new budget classification that in principle allows the tracking of all federal funds allocated to ministries, federal entities and public companies for S&T-related expenditures. At the same time, these regulations created a specific budgetary line (called "Ramo 38") for this agency.

In Mexico, the federal financing of S&T policy has three main channels:

- budgetary appropriations of sectoral ministries that fund research institutions operating under their responsibility, and S&T funds or programmes that they manage directly or in collaboration with other government bodies;
- budgetary appropriations of CONACYT which include the fiscal resources allocated to CONACYT to finance the S&T funds, programmes and support instruments it manages (or co-manages), and the fiscal resources allocated to the 27 CONACYT research centres;
- foregone budget revenue derived from the R&D fiscal incentive introduced in 2001; this can be readily measured as the fiscal incentive measure has an annual ceiling set by the Ministry of Finance enacted in the federal budget law.[18]

As shown in Tables 3.1 and 3.2 the bulk of the federal S&T budget (97.2%) is allocated to six sectoral ministries (Education, Energy, Agriculture, Health, Economy, Environment) and CONACYT.

Table 3.1. Federal expenditures in S&T, 2002-08

Millions of 2006 MXN

Sector	2002	2006	2007	2008
Education	9 679	11 873	10 381	11 480
CONACYT	9 870	10 282	11 477	13 175
Energy	6 080	4 921	5 656	6 305
Agriculture	2 370	2 108	2 290	3 331
Health	1 311	2 036	2 126	2 181
Economy	736	658	954	633
Environment	527	558	588	827
Others[1]	762	356	152	151
Total	**31 335**	**32 791**	**33 624**	**38 083**

1. Including Communications and Transport, and Foreign Affairs.

Source: CONACYT.

Table 3.2. Federal S&T expenditures by government department and main activity funded, 2006 (%)

	Education	Energy	Agriculture	Health	Environment	Economy	Communication and transport	CONACYT[1]	Others	Total APF[2]
Elementary education	0.3	-	-	-	-	-	-	-	-	0.1
Upper-secondary education	0.1	-	-	-	-	-	-	-	-	0.0
Tertiary education (ISCED 5A, 5B)*	0.1	-	-	-	-	-	-	-	-	0.0
Postgraduate education (ISCED 6)*	34.7	-	19.4	-	-	-	-	0.3	-	13.3
Education services support	0.3	-	-	-	-	-	-	-	-	0.1
Scientific research	54.9	87.1	80.5	100	33.5	-	-	23.6	-	52.0
Technological development	0.2	-	-	-	66.5	-	100.0	14.5	73.7	6.6
Scientific and technological (S&T) services	9.3	12.9	-	-	-	-	-	4.5	-	6.8
MSMES[3]	-	-	-	-	-	18.2	-	-	-	0.4
Innovation and competitiveness	-	-	-	-	-	81.8	-	-	-	1.9
Support to S&T development	-	-	-	-	-	-	-	53.9	-	17.5
Others	0.0	-	0.1	-	-	-	-	3.2	26.3	1.2
Total	100	100	100	100	100	100	100	100	100	100
Total budget (USD millions)	1 006.0	515.1	221.9	120.5	55.7	70.0	6.8	965.4	13.9	2 975.3
Share of total budget	33.8	17.3	7.5	4.0	1.9	2.4	0.2	32.4	0.5	100

1. Includes the budget allocated to CONACYT and CONACYT Research Centres.
2. Public Federal Administration (APF).
3. Micro, small and medium enterprises.

* UNESCO (1997), International Standard Classification of Education (ISCED): 5A and 5B include first degree and higher technical education; ISCED 6 refers to Specialties, Master and PhD education levels.

Source: S&T National Accounts.

3.3.1.1. Federal ministry funding and internal resource allocation

The Ministry of Education (SEP) was the best endowed until 2006 with more than a third of the total federal S&T budget. The largest share of its S&T expenditures goes to:

- scientific research and infrastructure (55%) funded either through institutional block grants to public higher education institutions[19] or through its contribution to the SEP/CONACYT sectoral fund for basic research;
- postgraduate education (34.7%), which includes its contribution to scholarships.

The Ministry of Energy (SENER) allocates almost its entire S&T budget to the financing of the research institutions under its responsibility, the Mexican Petroleum Institute (IMP), the Institute of Electrical Research (IIE) and the National Institute for Nuclear Research (ININ).[20]

The Ministry of Health (SS) divides its resources between the financing of basic and applied research in hospitals and a number of specialised institutes and laboratories.[21]

The Ministry of Economy splits its S&T budget resources between the following activities:

- support of technological upgrading of SMEs and innovative activities in micro, small and medium-sized enterprises (MyPyME Fund);
- promotion of innovative clusters;
- provision of technological services through institutions under its responsibility, the Mexican Institute of Industrial Property (IMPI) and the National Metrology Centre (CENAM);
- subsidisation of private law intermediary institutions that facilitate technology transfers to enterprises;
- contribution to the sectoral Technological Innovation Fund co-financed and co-managed with CONACYT.

The Ministry of Agriculture mainly allocates its S&T resources to research institutions under its responsibility, principally the National Institute of Forestry, Agriculture and Stockbreeding Research (INIFAP). It also shares with CONACYT the financing and management of sectoral funds.

With the exception of the Ministries of Education and of Economy, all other sectoral ministries devote an overwhelming share of their S&T resources to the institutional funding of specialised research institutes under their responsibility. Thus, their financial participation in CONACYT sectoral funds that finance S&T projects with selectivity criteria that approach competitive funding procedures is limited.[22]

3.3.1.2. CONACYT central administration funding and resource allocation

Since 2002, the first year in which it had its own line in the federal budget, and up to 2006 CONACYT's budgetary resources have stagnated in real terms. The share available to the central administration to fulfil its missions has diminished relative to that allocated to its 27 research centres.[23]

Table 3.3 illustrates the evolution of CONACYT's allocation of its resources among the programmes it supports and the funds it finances (or co-finances) according to broad S&T policy areas between 2002 and 2006. The area that receives by far the largest amount of funding is development of human resources, in particular the postgraduate scholarship programme and the financing of the SNI.

Table 3.3. CONACYT budget allocation by instrument and policy focus

USD (year 2003) millions

Instrument	2002	2006	Accumulated 2002-06 (%)	Financing and/or management responsibility
Human resources development				
National researchers system (SNI)	111.2	133.1	23.5	CONACYT
Postgraduate scholarships	190.4	188.1	36.0	CONACYT
Post-doctorate scholarships	0	8.5	0.9	CONACYT
Other[1]	6.4	13.1	1.6	CONACYT
Subtotal	372.2	361.2	61.1	
Basic research				
Education/CONACYT Fund	64.2	18.5	6.8	Shared
Others[2]	0	3.8	0.2	CONACYT
Subtotal	64.2	22.3	7.0	
Problem-oriented research and technological development (sectoral)				
Sectoral funds (other than education and economy)	32.8	19.9	3.6	Shared with sectoral ministries
Public/private partnerships	0	18.9	0.9	CONACYT
Subtotal	32.8	38.9	4.5	
Applied research and technological development (regional)				
Mixed funds	24.6	16.8	4.2	Shared with states
Support to business R&D and innovation				
Economy/CONACYT Fund	11.6	7.5	1.7	Shared
AVANCE	0	0	1.0	CONACYT
Entrepreneur and Guarantee Fund	0	2.6	0.4	Shared
Other	3.5	0.5	0.3	
Sub-total	15.1	10.6	3.4	
Other				
Miscellaneous[3]	75	90.5	19.9	CONACYT
Total CONACYT (central administration)	519.7	500.5	100	
CONACYT research centres	*369.5*	*432.9*		

1. Includes scientist repatriation programme.
2. Includes special funding of HEI laboratories (*e.g.* CINVESTAV).
3. Includes CONACYT administrative expenditures and operating subsidies to various institutions (*e.g.* the Mexican Academy of Sciences, FCCyT, ADIAT).

Source: FCCyT (2007) and own calculations.

- The postgraduate scholarship programme launched in 1971 has contributed significantly to Mexico's relatively good performance in the training of engineers and technicians. Other government departments also contribute to the financing of this programme, mainly the Ministry of Education and, to a lesser extent, the Ministry of Health. CONACYT's share in the total number of scholarship granted by the federal government increased from 33.4% in 1997 to about 58.5% in 2006.
- The financing of the National Researchers System (SNI) absorbed close to a third of CONACYT's central budget in 2006. This budget line is the one that grew the fastest and the volume of resources should grow mechanically with the regular increase of SNI members.[24]

CONACYT's financing of basic research from its central administration budget is essentially its contribution to the Basic Science Fund co-funded by the Ministry of Education. This fund finances projects presented by individual researchers or groups of researchers from public and private institutions.[25] It is operated on a competitive basis through peer review. Resources devoted to the fund have decreased regularly since 2002.

CONACYT also finances basic research and scientific infrastructure indirectly through its institutional block grant to its research centres which develop knowledge and teaching activities in exact, natural and social scientific disciplines.[26]

Funding of problem-oriented research and technological development is mainly channelled through the sectoral funds and mixed funds introduced in 2002 as well as through small-scale public/private partnership research and innovation support programmes:

- The 17 sectoral funds jointly financed by sectoral ministries (other than Education and Economy) or other federal institutions are for the implementation of projects that promote the development of STI capacities in the production of goods and services in sectors under the competence of these ministries/institutions and, in principle, according to their strategic needs. Projects are selected through administrative procedures involving peer review.
- The 32 mixed funds financed jointly with the federal states fund STI capacity building projects in priority areas defined by the states. CONACYT is involved in the selection of the projects.
- CONACYT launched two public/private partnerships that also fall in the category of support to problem-oriented research, the megaprojects and consortiums programme. They have been very poorly endowed and are little more than policy experimentation.

Over the PECYT period CONACYT became involved in support to business R&D and innovation. This support remained limited in volume and was channelled mainly through:

- The Economy/CONACYT Trust Fund,[27] which benefits from concurrent resources from the Ministry of Economy, supports innovation projects presented by the enterprise sector. Grants are provided to selected projects on the condition of matching funds by the enterprise(s).

- The AVANCE programme to support science-based innovative projects of enterprises during the transition from research to application. The programme's total funding remained limited over the period. It provides grants and, jointly with the Mexican Development Bank (NAFIN), can lower the cost of access to complementary risk capital and guarantee schemes. In principle, supported projects are in areas defined as priority in the PECYT.

While CONACYT's allocation of resources among the programmes it supports and the funds it finances (or co-finances) should in principle reflect the STI priorities defined by the PECYT, the actual allocation pattern shows strong inertia and strong fragmentation. This highlights the fact that CONACYT's initiatives were taken at the margin of its mainstream actions and lacked critical mass. This was particularly the case for programmes in support of applied research or linkages between science and industry. This fragmentation also raises the question of the focus of CONACYT's action and of its role in the overall governance of Mexico's STI system. This question is addressed further below.

3.3.1.3. R&D fiscal incentive

With the support of Congress CONACYT has played a major role in the creation of the fiscal incentive system. The rationale for this system was the need to support R&D and innovation in the enterprise sector not only to raise its competitiveness but also to stimulate demand for R&D and thus leverage linkages with the supply side, in particular with public research institutions, and to stimulate the recruitment of highly qualified human resources by enterprises.

From its inception in 2001 the resources devoted to the R&D fiscal incentive system (in terms of foregone budget revenues) increased eight-fold from MXN 500 million to MXN 4 billion in 2006 (in current MXN).[28] In comparison, total federal direct appropriations for S&T remained largely stagnant at an average of around MXN 33 billion over the period, while government expenditures on R&D grew moderately for an average level of around MXN 26 billion. This highlights a major quantitative and qualitative shift in the Mexican S&T policy mix, particularly as regards the emphasis on support to business R&D.

3.3.2. Priority setting and policy mix

3.3.2.1. Priority setting: reality or rhetoric

While the main challenges affecting the performance of the STI system were increasingly recognised during the period from the 1982 crisis to the end of the 1990s, priority setting in terms of broad policy areas or of S&T areas, target groups and types of R&D and innovation remained ineffective. Lack of prioritisation induced by weak governance hindered the government's capacity to steer the STI system to overcome the "low-level equilibrium trap" and foster the emergence of a virtuous dynamic in which public S&T investment and incentives effectively leverage private investment in R&D and innovation activities to meet social needs and raise competitiveness. Conflicts among interest groups, bureaucratic rivalries and stakeholders' opportunistic behaviour in a context of scarce budgetary resources and weak evaluation processes added to the problem.

Based on a sound diagnosis of the challenges and the obstacles hindering efficient steering of STI policy, the PECYT, the 2002 S&T Law and the Organic Law establishing CONACYT under the authority of the President of the Republic represented a valuable attempt to steer STI policy according to relatively well-defined priorities with adequately endowed and efficiently managed programmes in a context of a political commitment to substantially increase resources devoted to R&D.

In general terms, strategic orientations of the PECYT were not very original: *i)* promotion of state S&T policy through more efficient governance of the STI system with a more prominent role (and more resources) for CONACYT; *ii)* strengthening of national STI capacity through better funding of public research institutions and development of human resources for S&T; and *iii)* raising the innovative capacity of the enterprise sector.

The PECYT proved more innovative in establishing specific funds and programmes, incentive schemes, legislative and regulatory changes, and financing instruments to implement the strategic orientations. It also defined priority or strategic S&T areas that would benefit from a critical mass of resources, dedicated funding programmes, or the use of criteria that favour these areas when selecting projects for support by various programmes or financial instruments.

Strategic S&T areas were selected on the basis of their importance for socioeconomic development, the existence of a critical mass of researchers, the potential to reduce technological dependence, and the opportunities for the creation of internationally competitive businesses (CONACYT, 2001, pp. 95-96). The areas selected were Information and communication technologies, Biotechnology, Advanced materials, Design and manufacturing processes, and Infrastructure and rural and urban development, including their socioeconomic aspects.

While the PECYT expected that investment in strategic areas would be channelled through sectoral programmes, this did not happen largely because CONACYT did not have the necessary authority, in particular to tap sectoral ministries S&T budgets to fund these programmes and participate in their management. As a result, the strategic priorities were diluted in the projects selected, mainly for sectoral funds. Another reason was of course the lack of sufficient public resources in spite of the political commitment to increase Mexico's investment in R&D to 1% of GDP by the end of the PECYT in 2006.

Priority setting therefore was unable to overcome the inertia or opposition of the institutions involved in the governance of the STI system. The FCCyT, which should in principle have at least a consultative role in determining priorities, could not reach a consensus.

CONACYT managed to muster the institutional and financial means to implement one policy priority: support to R&D and innovation in the enterprise sector through the establishment of the fiscal incentive scheme. This was largely due to the fact that the resources to finance the scheme were not subtracted from those allocated to any other fund or support programme.

The PECITI has maintained the principle of setting S&T priority areas in line with the strategic orientations defined by the sectoral ministries and has kept the jointly operated sectoral funds as the main means of implementation.

3.3.2.2. The implicit policy mix

The adaptation of the S&T policy mix to new priorities and the evolution of challenges to the STI system appears largely constrained by institutional inertia, modes of co-operation among funding departments and entrenched interests. This situation cannot easily be overcome with weak governance mechanisms and a low level of resources. The implicit policy mix is apparent in the allocation of resources among funds, support programmes and incentive schemes and in qualitative changes in the regulatory framework that impinge on the performance of actors of the system.

Tables 3.1 and 3.2 show the allocations of S&T resources between CONACYT and sectoral ministries and within CONACYT and highlight the relative importance of various policy areas in the policy mix. They do not include the increasing weight of support to business R&D and innovation through the fiscal incentive. When this is taken into account the main characteristics of the evolution of the policy mix over the period 2002-06 are:

- On average the main component is support for human resources for S&T through the financing of the SNI and scholarship programmes.
- Support to R&D and innovation in the enterprise sector gradually becomes the major component, primarily owing to the fiscal incentive but also to the much more modest Economy/CONACYT Technological Innovation Fund.
- Support to problem-oriented applied research, including S&T infrastructure, mainly to research centres of CONACYT and sectoral ministries is the third largest component. In this category, support to public/private partnerships remained marginal.
- The relative importance of support to basic research, including scientific infra-structure, in public research centres and academic institutions through institutional funding of the Education Ministry and CONACYT and the Education/CONACYT Fund has decreased slightly over time, although resources for SNI also help support basic research;
- The development of regional STI capacities has taken on increasing importance owing to the establishment of the mixed funds and joint funding by CONACYT and the states. The development of innovative clusters has received increasing attention and support.[29]

Changes in the regulatory environment of STI actors, in policy implementation or in the mode of selecting beneficiaries of support programmes can also be seen as ways to modify the policy mix. The changes include:

- The radical shift from direct grant financing to indirect financing measures to support business R&D and innovation in the enterprise sector following the introduction of the fiscal incentives scheme.
- Greater management autonomy for public research centres which allowed them to keep revenue from the provision of S&T services and the results of co-operation with enterprises. The counterpart was a decrease in institutional funding.
- A modest shift in the financing of basic research, with a slight increase in the share of competitive funding of research projects.

3.4. The portfolio of instruments and programmes: a critical assessment

In the PECYT Mexico developed an unusually large number of programmes to support STI activities. They had many eligibility criteria and very cumbersome decision-making procedures. Alone or in co-ordination with other federal government or state bodies, CONACYT manages over 60 funds or support programmes. Given that only around 30% of CONACYT's total budget is devoted to these programmes – most of the rest is committed to financing the SNI and scholarships – many are poorly endowed and more akin to policy experimentation measures than to fully fledged support instruments. Two support programmes that deserve closer attention are the sectoral funds and the mixed funds available to enterprises and research institutions registered in RENIECYT (National Registry of Scientific and Technological Institutions and Enterprises).

3.4.1. Sectoral and mixed funds

3.4.1.1. Sectoral funds

The 17 sectoral funds are financed and operated in conjunction with sectoral ministries to promote STI capabilities according to the "strategic needs" of the participating "sector".[30] In the preparation of the PECYT their creation constituted a compromise between CONACYT and the sectoral ministries for the implementation of the strategic priorities defined in the PECYT. In fact, the selection criteria generally correspond to sectoral ministry priorities, usually defined at a very detailed level.[31] This distorts the selection process. Their budgetary endowments are quite small, averaging less than USD 100 million a year overall (Table 3.4). There is no fixed rule regarding the respective shares of the partners. Except in the case of the funds operated with the Ministries of Environment and of Agriculture, CONACYT is the major funder. The beneficiaries of sectoral funds are public research institutions, universities or research centres, although in principle enterprises are not excluded.

Table 3.4. Budget of the sectoral funds, CONACYT and partners

Total 2002-07, USD millions

	CONACYT	Partner	Total amount
Total sectoral funds	**308.9**	**230.0**	**538.8**
Education/ CONACYT	163.1	80.5	243.6
Environment/CONACYT	18.7	19.6	38.3
Economy/CONACYT	40.8	29.3	70.0
Health/CONACYT	26.9	32.8	59.7
Agriculture/CONACYT	20.0	25.3	45.3
Other sectoral funds[1]	39.4	42.4	81.8

1. Other ministries, including Communications and Transport, and Foreign Affairs.

Source: CONACYT and FCCyT.

Rejection rates are high.[32] Possible reasons are high demand with respect to available funding, poor qualifications of applicants, weak project relevance, bureaucratic conflicts between CONACYT and the partner ministry, and/or unclear criteria. Given the limited

amount of support these funds can offer, high rejection rates are likely to entail very high administrative costs for project selection.

To maintain the priorities set for the strategic areas of the PECYT, there may be a case for replacing sectoral funds focused on thematic research[33] by sectoral priority programmes with a larger contribution from the S&T budgets of sectoral ministries and funding on a competitive basis. This would be in line with practices increasingly observed in other OECD countries, in which the definition of priorities is accompanied by the setting of a budget of pooled resources allocated competitively by a "means agency" with oversight responsibility. This practice would be appropriate for sectoral funds oriented towards thematic basic or applied research, but probably less so for the Education/CONACYT and the Economy/CONACYT funds. It would also allow for more participation of the enterprise sector in projects financed by these funds.

3.4.1.2. Mixed funds

Progressively developed since 2001 and jointly administered and financed by CONACYT and state government bodies,[34] the 32 mixed funds were meant to play a significant role in fostering research and/or innovation capacity at the regional level and in articulating federal and regional STI policies and support programmes. These funds represented 4.2% of the CONACYT budget over the period 2002-06 and financed over 1 600 projects with an average investment per project of USD 1 000. CONACYT's financial contribution to individual projects varies but is never less than 50%. Although the mixed funds constitute in principle a valuable means of federal/state co-ordination, their present record is not strong:

- In many cases they have suffered from a lack of well-defined demand on the part of the states owing (at least in part) to inefficient co-ordination among stakeholders, especially in less developed states. On the whole they have been of greater benefit to the narrowly defined S&T interests of locally established research centres and HEIs.[35]
- The amount allocated per project has generally been quite small and mixed funds have supported a narrow base of projects with limited spillovers to regional innovative capacity.[36]
- Their management and effectiveness have often suffered from lengthy selection and disbursement processes and from a number of states' weak capacity to develop and submit adequate R&D and innovation projects.

In light of experience, their success would seem to depend on several factors:

- enhanced capacity at state level to develop an innovation strategy involving local stakeholders;
- support for projects with critical mass which build on local public S&T capacity to enhance collaboration, notably for technological cluster development as several states have done;
- increased federal support to build such capacity in less developed states;
- streamlining of management procedures.

3.4.1.3. Management issues

More often than not countries that have established funds that are co-financed and managed by different government bodies have encountered problems of implementation. Mexico is no exception and, apart from requiring more substantial resources, the funds need clearer and more efficient rules for managing the schemes. Among beneficiaries there seems to be widespread consensus that, in addition to their limited endowment, sectoral and mixed funds suffer from inefficient management and delayed disbursement of funds to selected projects. Moreover, the advisory panels responsible for screening projects are generally composed of SNI members who may have a bias towards basic research projects. Therefore, decision processes are at times influenced by vested interests and, in the case of mixed funds, they are often complicated by differences in objectives and procedures between federal and state entities. However, CONACYT has recently taken steps to streamline the management of these funds.

3.4.2. Direct support of business R&D and technological innovation

A number of programmes or financing instruments to support business R&D and innovation were developed and implemented in the PECYT. These initiatives have generally had a positive effect on enterprises' investment in R&D and innovation-related activities, as illustrated by the growth of business R&D expenditures over the period and the increasing share of business in the financing and performance of total domestic R&D activities. This upward trend, which highlights important growth in the number of firms engaged in S&T-related activities over the last seven years,[37] has been boosted by the increase in public support. Indeed, between 2002 and 2005 the share of direct government financing of total business R&D investment increased from 1.5 to 5.7% (OECD, 2007f). Moreover, if the budgetary cost of fiscal incentives is added to the amount of direct support, the percentage of business R&D financed by government reached about 25% in 2005 and probably more in subsequent years.

At central level, CONACYT and the Ministry of Economy[38] are the main sources of support for business R&D and innovation, along with some intermediary institutions. In this area there is an important bias in the policy mix: the wide discrepancy between the amount of resources allocated to the fiscal incentive scheme and the amount allocated to other instruments, given the nature and relative importance of market or systemic failures the various instruments are meant to address.[39]

3.4.2.1. The Technological Innovation Fund (Economy/CONACYT Trust Fund)

This fund, created in 2002 under the PECYT,[40] is jointly funded and operated by CONACYT and the Ministry of Economy and provides financial support to innovative projects proposed by individual firms or groups of enterprises. Supported projects should involve the development of new products, services or processes. They are selected on a competitive basis with criteria (or selection preferences) related to priority sectors, linkages with public research institutions, and size of the enterprise. Funding can cover up to 50% of the innovation-related costs and requires matching funds. Selection is made by administrative and expert committees.

Over the PECYT period the fund's endowment remained rather small. Between 2002 and 2006 the fund distributed around USD 63 million, of which CONACYT's share was close to 60%. Rejection rates were high throughout the period, approaching 90% in all but one year.

Funding mainly benefited medium-sized and large firms until 2005[41] and a majority of funded projects involved co-operation with federal or state public research institutions (Tables 3.5 and 3.6) but very little with other firms.

Table 3.5. Distribution of funding by firm size

Percentages

Firm size	2002	2003	2004	2005	2006
Micro	17.4	1.2	10.1	2.4	27.5
Small	24.2	17.6	27.8	26.7	48.7
Medium	40.8	12.9	27.9	31.3	14.6
Large	17.6	68.5	34.2	39.7	9.2
Total	100	100	100	100	100

Source: Based on information from CONACYT.

3.4.2.2. Other direct support programmes

In contrast with the sectoral and mixed funds, the Mexican administration has developed other means of direct support of R&D, innovative activities or technological development, which have proved more efficient in terms of management and co-ordination, and probably more successful in terms of outcomes. Prominent among these are the PROSOFT programme and the SME Fund financed and managed by the Ministry of Economy, and the AVANCE programme developed by CONACYT.

Table 3.6. Projects in co-operation supported by the Economy/CONACYT Fund, 2002-05

Percentages

	2002	2003	2004	2005
Projects with linkages (%)	48.2	49.2	89.1	86.9
Public research centres	44.4	41.9	29.8	30.1
Federal higher education institutions	51.9	12.9	31.6	24.7
State higher education institutions	3.7	38.7	35.1	34.2
Firms	0.0	3.2	0.0	0.0
Others	0.0	0.0	3.5	11.0
Projects without linkages	51.8	50.8	10.9	13.1
Total	100	100	100	100
Total number of projects	56	63	64	84

Source: Based on information from CONACYT.

The PROSOFT programme, which was introduced in 2002, does not specifically aim at fostering R&D or technology capacity building. Its role is to provide support for the development of enterprises in the ICT sector. PROSOFT manages funds from three sources: the federal government,[42] the state government and the companies that submit projects to the programme through "promoting organisations" that facilitate the review and management processes. It is praised by its beneficiaries for the simplicity of its management and the swiftness of its decision and disbursement procedures. Unlike several instruments to support innovation managed by CONACYT, PROSOFT has enjoyed a relatively important and sustained flow of resources.43 Its economic impact is quite positive in terms of job creation, firm creation, technological infrastructure, spillovers and cluster formation, and productivity. The shared interests among stakeholders, their joint participation in the financing of projects and a more "participatory" approach to decision making have probably facilitated the programme's success. A further step would probably be to build upon this success to develop similar initiatives in other priority sectors and use this type of programme as one way to promote regional technological clusters and build linkages with the regional research base.

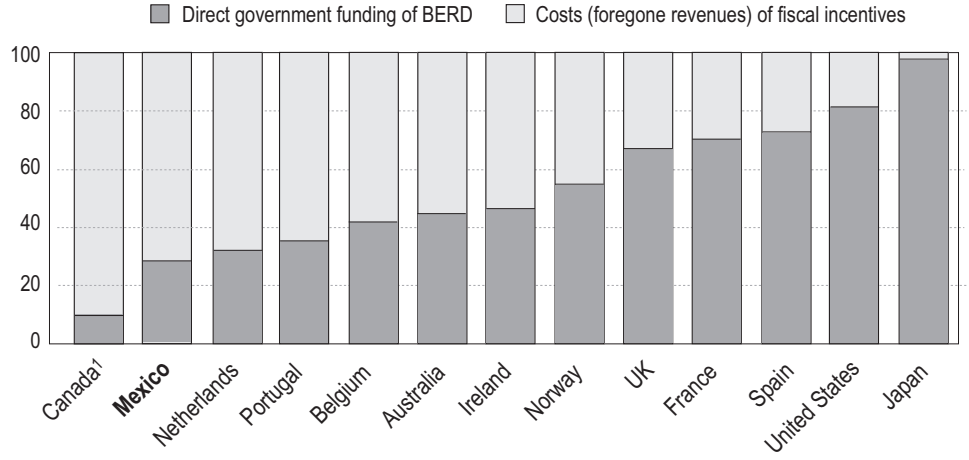
The *SME Fund* of the Ministry of Economy is another notable example of a successful bottom-up initiative by entrepreneurial stakeholders. Although not primarily focused on fostering innovation and technological development, it does have a line of action in this area. It has supported valuable initiatives owing to the role played by intermediary institutions in the design and submission of projects for funding, with matching resources from state and local governments and enterprises. Initiatives supported by FUMEC (the Mexico-United States Foundation for Science) for the development abroad of high-technology Mexican SMEs and the technological upgrading of supplier networks of firms in high-technology sectors dominated by multinationals are particularly noteworthy. The Monterrey Technological Institute for Higher Education (IESTM) and the State of Jalisco have developed high-technology clusters. In spite of limited resources, their leverage and economic impact have been quite high. These examples show that a key to successful support programmes aimed at enhancing the innovation capacity of SMEs in Mexico or at expanding their internal and external markets is reliance on dedicated intermediary institutions, often at the local level, which can efficiently manage projects and channel resources for their implementation. It also shows the importance of decentralised design and implementation of innovation support programmes.

The *AVANCE programme* managed by CONACYT is another example of a well-designed initiative to help technology-based innovative firms (or other entities) to bring new products, processes or services derived from research results to the market in priority areas defined by the PECYT. Well-defined eligibility criteria and operating rules have been developed in consultation with beneficiary stakeholders, decision procedures are clear and disbursement is swift. Unfortunately, the programme has been poorly endowed and the bulk of its resources go to relatively mature projects that are in the later stages of development. The financial components of AVANCE – the provision of risk capital and guarantee funds – are in principle co-financed by NAFIN in the framework of joint trust funds with CONACYT. These funds are new and their endowment is limited. Start-ups are therefore generally excluded from this programme.

3.4.3. The fiscal incentive system

Mexico's use of a fiscal incentive to support business R&D is not an exception among OECD countries. This incentive, introduced in 2001 and amended in 2002 at CONACYT's initiative, was a tax credit amounting to 30% of R&D expenditures to be deducted from corporate tax liability up to an annual ceiling on total credits which is determined each year by law. Over time this ceiling has been raised from MXN 500 million in 2001 to MXN 4.5 billion in 2007. Until it was suppressed in the 2009 S&T budget (see section 3.4.3.1 below) this fiscal incentive was by far the best endowed financial instrument in support of R&D and innovation. In 2006 it represented more than 75% of government support to business R&D. In this regard, Mexico's generosity stood out among OECD countries.[44]

Figure 3.1. Shares (%) of fiscal incentives and direct funding in total support to business R&D, 2005



1. Canada's fiscal incentive is much less generous than Mexico's. Direct support provided by provincial governments can be quite substantial but is not included.

As shown in Table 3.7, the design, management, scope of expenditures covered and "subsidy rates"[45] of R&D incentives vary widely across countries. However, the features of Mexico's system, as well as its weight in the overall public support of business R&D, were quite unusual by international standards.

Global ceiling for fiscal expenditures. Along with Hungary, Mexico was the only OECD country for which an annual global ceiling for total fiscal expenditure associated with the incentive was determined by the Ministry of Finance and voted into law. Apparent reasons for the ceiling may have included the perceived weakness of the tax collection system and the possible magnitude of fiscal fraud or evasion, as well as bad past experience with a multiplicity of tax incentives or loopholes granted to vested interests or to reduce the impact of price adjustments for disadvantaged social groups.[46]

Discretionary management of the incentive. Setting a global ceiling on foregone tax revenues induced by fiscal incentives leads automatically to a selection among project proposals submitted by firms seeking to benefit from the incentives during the year in which the ceiling applies. In Mexico this procedure was managed by an inter-ministerial committee, which included CONACYT and the Ministries of Finance, of Economy and of Education, on the basis of recommendations of panels composed of scientists and technology experts.[47]

Table 3.7. R&D fiscal incentives in OECD countries, 2006

	Volume of R&D	Increment of R&D	SMEs	Extended eligibility or additional incentive	Limitations
Tax credits					
Canada	20%		35%[5]	Extended carry forward	Ceiling of USD 2 million for SMEs
France	10%	40% over past two years	Tax exempt. for young science-based firms	Patents (incl. protection); immediate refund for new firms; double offset for wages of new Ph.D. recruit (1 year)	Ceiling of EUR 16 million a year
Ireland	20%	20%			
Italy	10%		30%	Wages of returning scientists	
Japan	10%		12%		Ceiling of 20% of taxable income
Korea	7%[1]	40%	15 and 50% on increment over four years		10% tax credit for R&D facilities
Mexico	30%			Patents and software	Ceiling of total amount of incentives (USD 450 million in 2007); granting of incentive by project.
Netherlands	4%		42%		Tax credit covers wages of R&D personnel, ceiling of EUR 110 000; subcontracting restrictions.
New Zealand[2]	15%				
Norway	8%		20%		Ceiling of USD 660 000
Poland	30%		50%		
Spain	30%	50% over past two years		Patents and software	Ceiling of 35% of corporate tax
Turkey	40%				
United States		20%		Patents for own research	Ceiling of 25% of tax liability over USD 25 000
Tax allowance					
Australia[3]	125%	175% over past three years		Patents and software	Floor of USD 16 000
Austria	125%	135% over past three years			Ceiling of EUR 100 000 for extramural R&D
Belgium	113.5%		118.5%	50% on wages in public/private collaboration	
Czech Rep.	200%				
Denmark	150% for sponsored R&D at PRI		150% (additional)		Limited to collaborative R&D
Hungary	200 to 400%[4]			Patents and software	Ceiling of USD 260 000; subcontracting restrictions
United Kingdom	125%		150%[5]		Subcontracting restrictions

1. On facilities.
2. Introduced in 2007.
3. Small firms in tax loss position can claim R&D tax refund equal to tax concession.
4. Depending on institution.
5. Small firms in tax loss position can claim R&D tax refund equal to a fraction of cash cost of qualifying R&D (25% in the United Kingdom, 35% in Canada under certain conditions).

The procedure had a number of negative aspects. It was a *de facto* "rationing" that favoured projects presented early in the year, irrespective of their quality; furthermore a disproportionate number of projects were submitted close to the submission deadline; the resulting overcrowding effect reduced the quality of evaluation of latecomers. The rationing effect may also have resulted in the allocation of an incentive lower than the requested amount. This uncertainty may have affected firms' strategic decisions or may have led them to inflate the costs of the R&D expenditures in the project(s) they submitted.

Finally, given the number and the variety of projects submitted for tax credits (3 155 in 2006), it may be asked whether the pool of experts used to evaluate them was sufficient in number and always had the necessary expertise.

These shortcomings were compounded by the fact that, by law, the global amount of fiscal incentives that could be awarded in a given year had to be allocated according to a predetermined quota and certain stated priorities.[48] While it is legitimate to determine priorities for the allocation of public support to industry, a selection process involving more than 3 000 proposals can be difficult, especially since, as is likely, firms tend to design their proposals so as to reflect these priorities. Prioritisation is therefore likely to be counter-productive and to hinder the evaluation process.

Scope and eligibility. Although the eligibility criteria for R&D expenditures were in principle those defined in the OECD's *Frascati Manual* (OECD, 2002), expenditures that have benefited from the incentives encompassed other innovation-related expenditures, technological upgrading and even acquisition of capital equipment for production rather than for research. In fact the selection criteria (which included attraction of foreign investment) have distorted the pursuit of the primary objective of the scheme which was to raise investment in R&D.[49]

Table 3.8. Mexico's programme of R&D fiscal incentives

Number of approved projects and share of amount granted by size of firm, 2001-06

Firm size	2001		2002		2003		2004		2005		2006	
	A	B	A	B	A	B	A	B	A	B	A	B
Large	346	69.6	577	69.9	698	70.1	939	79.7	1 374	80.8	1 058	78.5
Medium-sized	250	26.5	322	22.1	323	20.7	423	14.9	576	12.6	351	14.9
Small	58	3.0	109	6.4	141	8.4	141	3.8	239	4.9	131	5.2
Micro	25	0.9	59	1.6	35	0.8	104	1.5	172	1.8	76	1.4
Total	679	100	1067	100	1197	100	1607	100	2 361	100	1 616	100

A: number of approved projects; B: share of amount granted (%).

Source: CONACYT.

The fiscal incentive system has undoubtedly contributed to the growth of business R&D and the technological upgrading of Mexico's capital-intensive manufacturing industry over the last seven years and in this respect has achieved some of its objectives. However, in addition to the limitations related to its design and management highlighted above, several others call into question its efficiency in addressing the R&D and innovation challenges faced by Mexican enterprises:

- Fiscal incentives are generally used by firms already engaged in R&D and innovation activities in order to develop incremental innovations. Therefore, a disproportionate share of the benefit of the scheme accrued to large enterprises and, to a lesser extent, to smaller ones with experience in R&D management. As illustrated in Table 3.8, in 2006 close to 80% of fiscal incentives went to large

enterprises in a few sectors.[50] Moreover, there was no ceiling on the benefits that could accrue to a single enterprise. SMEs were also disadvantaged by a lack of experience and the cost involved in submitting tax credit requests.

- There is reason to doubt whether there was much "additionality" in terms of investment in R&D that would not have taken place in the absence of the scheme. There was therefore some danger that the system gives rise to windfall profits and rent-seeking behaviour. Since the Mexican system was based on the volume of R&D rather than on its increment over the preceding year(s), the procedure tended to favour projects evaluated positively in the preceding year whether or not they include new R&D and innovation investment. This primarily concerns larger enterprises, often affiliates of multinational enterprises in sectors such as automobiles, chemicals, ICT and metallurgy (Lopez Martinez and Fernández Zayas, 2008).
- By design, the system could not efficiently support the vast majority of SMEs which face risks different from those associated with R&D investment and whose innovation projects do not necessarily involve R&D expenditures. In such cases, matching grants that support innovative ventures seem much more appropriate.

It can be argued that the rationale for and usefulness of fiscal incentives nonetheless exists in Mexico. Moreover, its elimination would send negative signals regarding policy continuity to the business community engaged in innovative activities. However, the re-introduction of fiscal incentives as a specific support scheme should not be envisaged without major design, financing and management reforms. It should be compatible, for tax credit rates, with the recently instituted "Single Rate Corporate Tax" system or IETU *(Impuesto Empresarial a Tasa Única)*. Possible reforms emulating best practices in OECD countries are detailed in Box 3.1.

3.4.3.1. A new package of R&D and innovation support programmes

In the context of the preparation of the 2009 S&T budget, it was decided to suppress the fiscal incentive and replace it by a new package of direct support programmes aimed at fostering R&D and innovation in the framework of the PECITI.[51] This package is endowed with MXN 2.5 billion for 2009 and is funded and managed by CONACYT. A strong component to protect intellectual property rights is built into this initiative which gives a bonus to co-operative projects. The package consists of three support programmes:

- INNOVAPYME supports R&D and innovation activities in projects of micro, small and medium size enterprises (MSMEs) with high value added, preferably undertaken in co-operation with other firms or public research institutions.
- INNOVATEC supports technological innovation projects aimed at raising the competitiveness of enterprises, preferably in co-operation with other firms or public research institutions. It also supports the development of S&T private infrastructure and the creation of private R&D centres.
- PROINNOVA supports R&D and innovation projects in "frontier technologies" undertaken in the framework of public/private co-operation, including public research institutions and SMEs.

All projects supported by these programmes can benefit from additional support for the inclusion of highly qualified personnel in the form of scholarships to holders of master's and doctorate degrees participating in the project for a period of up to 18 months.

Box 3.1. Fiscal incentives: possible reforms

1. Type of fiscal incentive

- *Maintain the tax credit* to be claimed against corporate tax liability as the form of fiscal incentive. Decrease the rate of benefits for volume-based R&D expenditures if an increment-based tax credit is instituted (see below).

2. Design

The system should be designed so as to ensure clarity, stability and low administrative costs of compliance with the rules that govern it. It should not discriminate against any type of firm that qualifies for eligibility, *notably as regards the incidence of the tax reform.*

- *Ceiling of total tax expenditures*. Abolish the ceiling of total tax expenditures as of the next fiscal year.
- *Ceiling of tax credit benefits for eligible enterprises.* Set a maximum tax credit benefit an enterprise can receive (presently large enterprises that benefit from the scheme get an average of USD 950 000 in tax credits).
- *Eligibility criteria.* Adhere strictly to the OECD *Frascati Manual* definition of R&D for tax benefit purposes. Ensure the wide dissemination of eligibility criteria by CONACYT.
- *Eligibility of enterprises.* As is currently the case, all qualifying enterprises subject to corporate taxation should be eligible, irrespective of type of activity. "Anti-fragmentation" rules should be applied to prevent enterprises from artificially splitting R&D expenditure claims among affiliates in order to maximise benefits.
- *Volume-based* vs. *increment-based tax credits.* Introduce a *mixed system with a higher rate for incremental expenditures* with a reference period of three years.[1] Given the costs incurred, the introduction of a mixed system would likely lead to reducing the present rate of tax credit for volume-based R&D expenditures. It is premature to propose tax credit rates for a mixed system but they could be between 15 and 20% for volume-based and between 45 and 50% for increment-based.
- *Targeted incentives.* Innovative SMEs and science-based start-ups face more financing problems than large enterprises, especially in a country like Mexico which lacks an active venture capital market. As in many OECD countries *extra (volume-based) incentives for SMEs seem to be justified* with a carry-forward provision. Similarly an extra incentive could be granted to *R&D expenditures incurred in co-operation with or contracted to public research institutions.* To maintain the neutrality of the fiscal incentive system and avoid duplication with sectoral priority programmes *no particular sector of activity should benefit from preferential tax credits.* Eventually Mexico could also emulate other OECD countries that use their fiscal incentive system to facilitate employment of highly qualified S&T personnel in enterprises, for instance by discounting social security costs or applying a multiplying factor to these personnel wages in the calculation of eligible R&D expenditures.

3. Management

- *Management responsibility.* CONACYT and the Ministry of Finance should jointly manage the fiscal incentive system.
- *Automatic* vs. *discretionary decisions*. The proposed elimination of the ceiling of total tax expenditures and *the institution of a ceiling for beneficiary enterprises* renders the cumbersome and bureaucratic discretionary decision process obsolete. It is recommended to adopt the lighter procedure used in most OECD countries, *i.e. automatic granting of the tax credit* to qualifying firms whose claims satisfy the eligibility criteria. Automatic granting should reduce management costs.
- *Compliance control*. *Develop* ex post *control procedures similar to those applied in other OECD countries.* The main responsibility for conducting these controls, and if needed determining penalties for firms guilty of tax evasion, would obviously be that of the Ministry of Finance but, as in other OECD countries, the institution in charge of S&T policy, CONACYT, should be involved in control procedures or at least be called on to provide advice.
- *Compliance costs.* Good management of the fiscal incentives system implies that all firms that are in a position to qualify for eligibility can actually do so. As mentioned above, compliance costs for submitting tax claims can be particularly high for smaller firms. CONACYT could eventually develop advisory programmes for first-time and smaller claimants.
- *Evaluation.* Introduce a regular evaluation system to monitor the impact of the fiscal incentive on firms' innovation strategy and performance. Link this system with innovation surveys.

1. Increment calculated over the average annual R&D expenditures during the last three fiscal years.

Table 3.9. R&D and innovation stimulus package, 2009

Level of support by programme

Programme (2009 budget)	Enterprise size	Percentage of funding over eligible expenditures			
		Individual project	Consortium project (Enterprises in collaboration with research institutions)		Ceiling of public funding per enterprise
		% enterprise expenditures	% enterprise expenditures	% consortium expenditures	(MXN millions)
INNOVAPYME (MXN 600 million)	MSME*	Up to 35%	Up to 50%	Up to 75%	18
PROINNOVA (MXN 700 million)	MSME	--	Up to 75%	Up to 75%	21
	Large enterprise		Up to 50%		
INNOVATEC (MXN 1.6 billion)	MSME and large enterprise	Up to 22%	Up to 30%	Up to 75%	36

* Micro, small and medium-sized enterprises.

Source: CONACYT, *www.conacyt.mx/Estimulos/Index_Estimulos.html*

The annual call for projects under these programmes and the evaluation modalities are the responsibility of an inter-ministerial committee composed of CONACYT and the Ministries of Finance, Economy and Education. CONACYT manages the programmes and the selection of projects in collaboration with the Mexican Association of Economic Development State Secretaries (AMSDE) and the Science & Technology State Councils. Projects are selected on a discretionary basis following consultation with technical committees. Here again, as in the case for sectoral and mixed funds, it may be feared that co-ordination problems associated with programme management and the "valuation" of projects which underpins their assessment and selection will limit the efficacy of the new programmes.

The new stimulus package has a relatively strong emphasis on SMEs and apparently recognises their diversity and the inadequacy of a "one-size-fits-all" approach. This is welcome given the bias against SMEs in the fiscal incentive system. Nevertheless, the package raises the question of the coherence and complementarity (or possible overlap) of the various programmes that support the strengthening of SMEs' technological and innovation potential, in particular between INNOVAPYME, the SME Fund of the Ministry of Economy and the Economia/CONACYT Technological Innovation Fund, on the one hand, and PROINNOVA and the AVANCE programme as regards the support to technology-based firms, on the other.

Before the creation of the new package, support to technology-based firms, in particular new ones, was a weak point in Mexico's policy mix. Only AVANCE and, to a lesser extent, the business accelerators initiative funded by the Ministry of Economy supported the development of research-based innovation activities in high-technology firms. These programmes fulfilled an important mission but were also under-funded and provided few opportunities for researchers from public research institutions to create high-technology firms or spinoffs. In this regard, beyond the stimulus package, more attention and support should be given to access to financial markets and the development of financial products (*e.g.* seed and venture capital) adapted to the creation of this category of firms.

Support to pre-competitive R&D projects undertaken in partnership by industrial firms and public research institutions (see section 3.4.4), including academic research centres, can also play an important role in the development of high-technology firms and academic spinoffs, as demonstrated by the experience of many OECD and non-member countries. In this context, the Israeli MAGNET programme is particularly interesting owing to the simplicity of its management (see Box 3.2).

Box 3.2. Israel's MAGNET programme

The objective of the MAGNET programme,[1] launched in 1994 and managed by the Office of the Chief Scientist of the Israeli Ministry of Industry, Trade and Employment, is to strengthen industrial companies' capacity to draw from a vast and varied research and technological pool, giving them the capability to develop innovative, high value-added products with important export potential. It has contributed significantly to the creation and initial growth of new technology-based firms, a process which has been particularly dynamic in Israel. [2]

The programme provides financial support to "pre-competitive" R&D projects developed jointly by enterprises and academic research institutes organised in the framework of a consortium specifically dedicated to the project and governed by "collaborative agreements" among parties. The intellectual property rights derived from technologies developed by a consortium belong to the members that developed it; however other members receive at no charge a licence to use the technology for further development of their own products.

Eligibility, management and selection criteria

- Every Israeli industrial entity can apply; consortia must be formed as legal entities with non-profit status. There is no limit on the number of companies participating in the consortium. There is no sectoral criterion.
- Projects presented by consortia are selected by the MAGNET Committee headed by the Chief Scientist, Ministry of Industry, Trade and Employment. The majority of members are external to his/her office.
- Projects are selected on the basis of: *i)* expected innovation output; *ii)* expected returns (benchmark is USD 10 in expected sales for USD 1 of R&D investment); *iii)* potential exports; and *iv)* academic contribution and partnership contributions. The MAGNET Committee checks if the consortium has the financial and human resources to carry out its proposed project.
- Outcomes are evaluated on a yearly basis with an impact on the following year's financing; a more in-depth evaluation is undertaken after three years. A comprehensive evaluation of the programme is carried out every seven years or so.

Funding

- The annual budget of the MAGNET programme is around USD 60 million to be disbursed as grants to the selected consortia (about 20% of total direct support to industrial R&D in Israel).
- Project expenses eligible for financing by the MAGNET programme are: salaries to the direct employees of the consortium plus overhead; research equipment and materials; patent- and licence-related costs.
- MAGNET grants to enterprises can amount to 66% of the approved budget. The consortium adds the rest, with the breakdown determined by the members of the consortium.

1. MAGNET is the Hebrew acronym for "Generic Pre-competitive Technologies and R&D".
2. Most of the approved consortia are in the areas of ICT, mechatronics, pharmaceuticals, and health and biotechnology.

3.4.4. Strengthening collaboration and linkages between public research and industry

3.4.4.1. Collaboration and partnerships

In Mexico, policies and support programmes focusing explicitly, as their primary objective, on fostering collaboration between enterprises and public research institutions for R&D and innovation activities have been weak. In this area, most current policy instruments support collaboration indirectly, to the extent that they include collaboration as a criterion of project selection in programmes with other priority objectives. This is particularly true for the former fiscal incentive system, the mixed funds and most of the sectoral funds. It also applies to the stimulus package introduced in 2009. Unfortunately, and probably in part owing to the low level of financing of the funds, the preferential treatment supposed to be given to collaborative projects has not yielded the expected results, with the exception of the Economy/CONACYT Fund (Table 3.5). The much better endowed fiscal incentive scheme did not effectively contribute to collaboration with public research institutions (Lopez Martinez and Fernández Zayas, 2008).

This highlights a principle that is particularly relevant in the Mexican case: support instruments should focus on the priority issue they are designed to address and not seek to meet a multiplicity of objectives. At the same time, however, those specifically designed to promote collaboration between public and private institutions, such as the competitive "Consorcios" programme launched in 2003 in the framework of the PECYT, have been rather unsuccessful. Factors in this relative failure include the lack of medium-term commitment, weak involvement of public and private stakeholders in the design of the programme, and, as elsewhere, poor funding. Industry-science relationships would be more efficiently fostered in the framework of well-funded dedicated programmes or instruments designed with the involvement of stakeholders.

Among such programmes public/private partnerships for research and innovation (P/PPs) figure prominently (see Box 3.3). These have a strong leverage effect on both public and private investment in R&D and their share in total public support to R&D and innovation has generally increased over time. This approach was emulated in Mexico in 2007 with the launch of the Strategic Alliances for Research and Innovation programme (AERIs) under which CONACYT awards competitive grants to projects jointly presented by at least two enterprises and two public research institutions.

With its strong focus on collaborative projects and its substantial endowment, the new PROINNOVA programme signals a renewed emphasis on public/private partnerships in Mexico's S&T policy. It is to be hoped that the efforts undertaken will not be compromised by co-ordination and management failures, as several government bodies are once again involved in the selection and implementation of projects. It also remains to be seen how the complementarity between the PROINNOVA and the AERIs programme will be managed.

Other actions rely on incentives provided by institutional reforms such as those on the mobility of researchers and the development of technology transfer or licensing offices (TTOs and TLOs) in research institutions receiving public funding.

Box 3.3. Public/private partnerships for research and innovation: a high-leverage public support instrument

An important conclusion of recent OECD work on the role of government in fostering knowledge-based growth is that greater use of public/private partnerships (P/PPs) can enhance the contribution of science, technology and innovation policy to economic performance. P/PPs for research and innovation offer a framework for the public and private sectors to join forces in areas in which they have complementary interests but cannot act as efficiently alone (risk sharing and mutual leveraging effects). They can fill some gaps in innovation systems more effectively than other policy instruments.

P/PPs are unique tools to promote collaborative research in areas where innovation is deeply rooted in science:

- Major programmes to promote strategic R&D co-operation among universities, public research institutes and private firms have been launched or reinforced in many OECD countries since the late 1990s, following the pioneering examples of the Australian CRC and Swedish Competence Centre programmes (*e.g.* Kplus and Kind/Knet in Austria, the Innovation Consortiums in Denmark, the National Technological Research and Innovation Networks in France, the Technology Leading Institutes in the Netherlands, and the CENIT programme in Spain).

- P/PP is the best approach to building innovative networks in new multidisciplinary research fields, either as stand-alone initiatives (*e.g.* Genomics in the Netherlands) or as part of broader P/PP programmes (*e.g.* nanotechnology, Gehomme and Genoplante networks in France, and the Kplus centre on bio-molecular therapeutics in Austria).

In addition to providing effective springboards for frontier and pre-competitive R&D in areas of strategic importance, P/PPs can contribute to other objectives and yield broad benefits:

- *Input, output and behavioural additionality*. Cost-sharing arrangements and industry leadership within P/PPs (as in the case of Spain's CENIT programme) translate into high leverage of public support on business R&D and innovation. P/PPs have also a lasting effect on the behaviour of public and private researchers, by contributing to build trust and personal networks that facilitate further formal and informal co-operation.

- *New avenues for commercial spillovers from public research*. P/PPs provide participating firms with easier access to public research outputs and facilitate the creation of new technology-based firms, especially spinoffs from public research, as well as the mobility of human resources between the public and private sectors (*e.g.* Israel's MAGNET programme, see Box 3.2).

- *Linking SMEs with scientific research*. Most innovative SMEs find it difficult to establish direct contacts with universities and public labs. P/PPs can play the role of effective bridging institutions (*e.g.* ProInno in Germany).

- *Increased synergies within and between regional innovation systems* (*e.g.* Korea's Regional Innovation Centre programme). National P/PP programmes can enhance co-operation between local innovative clusters in order to ensure critical mass and better exploit complementarities.

Whereas P/PPs can potentially achieve what other policy instruments cannot, handling them is a delicate matter since the partners must engage in sustained co-operation with partners from different managerial cultures and partly conflicting goals. OECD work points to the following critical factors for success:

- Long-term commitment from both government and industry, based on a shared vision.

- Critical mass but also depth of the national and regional innovation systems. P/PPs should not create "high-technology islands" but be embedded in local and regional innovative clusters, and benefit innovative SMEs as well as large firms. Programmes to promote large P/PPs can be complemented by measures to support smaller P/P research teams (*e.g.* Austria's CDL programme, Australia's ARC Linkage Grants and Fellowships programme).

- Building on existing networks without neglecting areas in which potential actors are still dispersed (*e.g.* multidisciplinary research) and/or inexperienced in accessing government support.

- Efficient steering mechanisms that ensure a sustainable balance between public and private interests, especially: *i)* competitive selection of projects and participants; *ii)* optimal financing; *iii)* efficient organisation and management; and *iv)* rigorous evaluation.

As compared with more advanced countries and major emerging economies (*e.g.* Brazil[52] and China) the development of such offices is slow in Mexico and the rules that govern the management of IPRs by public research institutions and the appropriation or allocation of the proceeds should be clarified. In this respect, the recently created IMPI/CONACYT Fund is a welcome initiative that should facilitate the development of TTOs and TLOs in, or attached to, Mexico's public research institutions.

3.4.4.2. Linkages and intermediation

For the overwhelming majority of firms, notably SMEs, the benefits to be gained from interaction with public research institutions cannot be derived from collaborative R&D and innovation activities. Expected benefits come from technology diffusion and transfer activities. In Mexico these activities are mainly developed by:

- CONACYT and sectoral ministries' research centres. The broader management autonomy granted to these centres (see below) has led them to develop more actively their activities related to the provision of technological services;
- intermediary institutions financially supported by sectoral ministries, such as the System for Technological Assistance to Enterprises (SATE), the Technological Accelerators initiative (TECHBA), the Centres for Productive Articulation (CAP) supported by the Ministry of Economy, or the PRODUCE and COFUPRO Foundations in the agricultural sector.

While there is certainly a rationale for supporting the supply of technological services by PRCs and subsidised intermediary institutions, it can be argued that this hinders the emergence of more open technology markets in which certified private brokers could compete with – or complement the action of – public or publicly supported institutions. In Mexico, as in many countries, this raises the question of the right balance between the support of supply and of demand for the provision of technological services.

3.4.5. Emergence of technological and sectoral innovative clusters

Although Mexico does not have an explicit technological cluster policy, policy initiatives at the federal, but perhaps more importantly at the state or municipal levels, have facilitated the emergence of technological and/or sectoral clusters in states such as Jalisco (electronics and high value added food and agro-industries), Guanajuato (biotechnology for agriculture and traditional industries), Nuevo Leon (software and electronics), Queretaro (machinery) and Baja California Norte (micro-electronics and biotechnology).

These clusters have benefited from support measures jointly funded at the federal (CONACYT and the Ministry of Economy) and state levels, often with matching funds from industry. However, a prerequisite for their success appears to have been strong participation of concerned business associations and intermediary organisations. Together with state and municipal authorities, these have fostered the development of technological infrastructure, human capital and knowledge transfers in collaboration with local higher education institutions and public research centres.

The consolidation of technological clusters is particularly important for strengthening regional innovative capacity and necessitates further action. Indeed, experience with cluster development highlights the catalyst role that government policy can play in promoting regional innovation when:

- there is strong commitment and involvement of local public and private stakeholders who put investment in knowledge at the centre of their social and economic development strategies;
- decentralised bodies lead the management of jointly funded programmes;
- attention is given in priority to technological infrastructure, in particular ICT, metrology, standards and managerial capacities, and to the organisation of knowledge spillovers and transfers between public research and industry and among enterprises participating in the cluster.

Building upon the experience and achievements of the cluster approach, the opportunity should now be seized to integrate it into a broader vision of regional innovation systems. This implies strengthening endogenous innovation capacities at local and regional levels through co-ordinated and complementary investment by the municipal, state and federal levels in S&T infrastructure for well-defined technological or sectoral priorities. This also requires removing constitutional or legal obstacles that impede co-operation among states or between municipalities in different states, such as the Federal Planning Law.

3.4.6. Public research

Mexico has a well-developed and diversified public research sector. It is geographically highly concentrated and its performance in terms of its contribution to S&T development and innovation is hindered by important management rigidities, overall resources constraints and research funding allocation procedures. However, institutions such as CINVESTAV, IPN and laboratories of some larger universities demonstrate that when these rigidities and constraints are overcome, achievements in scientific production, collaboration with industry and contribution to innovation can be remarkable.

Some reforms of the public research sector have occurred in recent years. They mainly concern the governance of CONACYT research centres and the development of S&T infrastructure in the context of efforts to decentralise higher education institutions. More need to be undertaken, notably as regards financing patterns and, eventually, the SNI.

3.4.6.1. Governance of public research centres: an unfinished process

CONACYT's and sectoral ministries' public research centres remain institutionally under presidential authority and are governed by the S&T Law and the Law on Para-public Entities. In recent years several changes in the governance and financing of these centres have led them to take a more proactive approach.

PRCs can now co-operate with public and private firms, realise joint projects with them, form technology-based firms and use resources obtained from the provision of S&T services, proceeds from collaboration projects with industry, and donations for scientific research and technological development. Most PRCs have increased the share of self-financing in their overall budget.[53] PRC researchers may participate in research projects with other (private) entities and receive income for their participation.[54] Legal modifications introduced in 2006 empower PRCs' governing organisms to establish the conditions of use and appropriation of their researchers' results and to set rules of confidentiality when profitable knowledge is generated in the framework of collaborative projects with industry or in technology-based firms created by PRCs. Further reforms are

needed, in particular in the regulatory framework that makes investment in equipment and personnel management still largely subject to centralised control, as this tends to adversely affect contractual arrangements with private enterprises and the management of intellectual property.

The institution of "performance agreements" established a governance mechanism which includes appraisals and accountability to increase transparency and induces the centres to give priority to research and technological activities or programmes with acknowledged social or economic relevance.[55]

The missions, governance and modes of financing of PRCs should evolve as the innovation system matures. Some should forge stronger links with the academic sector in their research and training activities and others with industrial associations more interested in applied research and the training of engineers and technicians that the centres can provide. However, the diversity of PRCs' missions means that greater management autonomy must be predicated upon the implementation of performance evaluation mechanisms and the generalisation of common governance structures or charters. In this regard, public research institutes co-ordinated by sectoral ministries should be subject to the same type of performance agreements as those of CONACYT centres. This would probably help increase transparency in S&T activities funded by the sectoral ministry responsible for their management and ensure greater efficiency in terms of research productivity and expected social benefits.

3.4.6.2. Patterns of financing, evaluation and accountability

The financing of public research come mainly from CONACYT's and sectoral ministries' funding allocation to public research centres, the Education/CONACYT Basic Science Fund, institutional funding of higher education institutions (HEI) by the Ministry of Education, and complementary income for SNI researchers.

Over the PECYT period the total budget for public research stagnated (except for the financing of the SNI). While resources devoted to problem-oriented research in PRCs have grown slightly, especially if proceeds from technological services offered by PRCs are included, those allocated to the Basic Research Fund have been on a downward trend since 2002, when CONACYT was separated from the Ministry of Education.[56] However, if problem-oriented research remains a priority, this should not adversely affect curiosity-driven research. In a virtuous circle, the latter nurtures the former at the same time as its agenda is increasingly driven by the former. The modalities of financing should strengthen this virtuous circle. The policy mix and the governance structure that support public research institutions have to evolve accordingly.

The volume of resources devoted to public research should increase and its allocation should ensure that funded research activities make an efficient contribution to the generation of knowledge, the training of highly skilled personnel, the solution of collective problems, and the strengthening of the innovation capacity of the productive sector. To this end, a better balance should be struck between institutional funding, competitive funding and other sources of funding. A growing share and volume of resources should be devoted to competitive funding through the restructuring of sectoral funds that support basic and applied research, which are presently financed and managed by CONACYT in co-ordination with the Ministry of Education and other sectoral ministries.

Institutional funding of public research is too limited, as it essentially only covers salaries and other current costs. Institutional funding[57] should probably continue to evolve according to traditional quantitative criteria (*e.g.* size of institution, salaries, training activities and current costs), but a non-negligible share should help finance discretionary research (including research infrastructure) in areas of specialisation defined by the institutions. Following best practices in other countries, the magnitude of institutional funding should be based on the results of periodic evaluations, with emphasis on the quality of research according to academic standards, as well as criteria pertaining to the contribution of researchers and other highly qualified S&T resources to innovation performance (*e.g.* patents and relationships with industry).[58] Moreover, increases in institutional funding should continue to be examined in light of the need to further decentralise research activities. Endowed with the appropriate resources, the Ministry of Education should continue to be responsible for the management of institutional funding of academic institutions.

Like large public institutions responsible for research funding in other countries, such as the US National Science Foundation, CONACYT would be responsible for the *competitive financing* of two categories of research projects:

- One covers the so-called "blank" projects that are selected on the basis of criteria of research excellence irrespective of scientific discipline, with an emphasis on collaborative projects. The source of finance would be the Education/CONACYT Fund for basic research, and its budget should increase in line with the country's evolving scientific potential.[59] Management should be entrusted to Conacyt to avoid delays in disbursement. The competitive selection of projects should give a clear premium to collaborative ones[60] and consideration should be given to an extension of the time horizon of funded projects.

- The second covers research projects submitted in the framework of research and innovation priority programmes defined in the PECITI. The source of finance for such projects would be a consolidated fund encompassing the resources previously available under the sectoral funds. This fund could be under the main responsibility of CONACYT in order to reduce the problems of co-ordination and dilution of responsibility that presently hamper the efficient management of the sectoral funds. The fund would finance medium-term research and innovation programmes[61] with emphasis on public/private partnerships such as those launched in the framework of the AERIs. Their management would be entrusted to a consortium of partners. Other countries that have funded such schemes with sufficient resources have found that they give public research institutions a strong incentive to reorient their scientific activities towards problem-solving research more closely related to innovation. An added benefit is a resource multiplier effect due to mutual leveraging of public and private resources. However, as emphasised above, the successful implementation of such programmes and of other forms of co-operation with the private sector requires a lessening of the stringent constraints on the hiring and mobility of research personnel and the purchase of equipment as well as less bureaucratic monitoring of implementation.

- Other sources of finance for public research should be more actively sought, in particular those stemming from international co-operation as part of CONACYT agreements. Public research institutions should also be encouraged to develop their own international collaboration networks and regulatory obstacles that hinder such developments should be removed or lessened.

Box 3.4. CINVESTAV's National Laboratory of Genomics for Biodiversity – LANGEBIO

Mexico is one of the world's countries with the highest degree of biodiversity. This genetic diversity represents an invaluable asset and a strategic advantage for crop improvement and biotechnological developments. The development of new technological platforms in the last 15 years, such as genomics, proteomics and metabolic profiling, has tremendously facilitated gene discovery, the identification of active compounds for medicine and the development of biotechnology-based industrial processes. To exploit the potential of Mexico's biodiversity it was necessary to create the human and physical infrastructure to carry out complex functional genomics projects. In this context the Mexican government decided to create a research unit to exploit functional genomics for the sustainable management of the country's biodiversity.

The creation of this unit, the National Laboratory of Genomics for Biodiversity (LANGEBIO), was proposed by internationally recognised scientists with experience in genomics[1] from the Irapuato Unit of Mexico's Centre for Research and Advanced Studies (CINVESTAV) in the State of Guanajuato. A formal proposal was submitted to the Mexican federal government.

It had the following major objectives: the development of a research unit capable of carrying out world-class research on the biotechnological utilisation of Mexican biodiversity, the provision of genomic services to national research organisations and enterprises, an effective programme for intellectual property protection and technology transfer and a solid programme of public awareness of biotechnology. The proposal included the acquisition of state-of-the-art scientific equipment, the creation of 70 permanent positions, including 18 principal investigators, technicians and support staff and the construction of new buildings.

In 2005, in an unprecedented action for Mexican science, three federal departments (CONACYT and the Ministries of Education and Agriculture) together with the Government of the State of Guanajuato signed an agreement to provide the USD 50 million required for construction, acquisition of all required equipment and creation of the new positions needed for the activities of LANGEBIO.

In spite of the difficulties imposed by Mexico's legal and regulatory framework for public spending and acquisitions, at the beginning of 2006 a state-of-the-art genome sequencing facility, undoubtedly the best in Latin America, was established in provisional laboratories provided by the Irapuato Unit of CINVESTAV. In parallel, Enrique Norten, one of Mexico's most prestigious architects, was chosen for the construction of LANGEBIO´s new buildings. An international search to hire new staff members was initiated in 2006.

The scientific challenges also began early on with a request by the Minister of Agriculture for the sequencing of the gene encoding regions of the maize genome. Gene enrichment techniques, high-throughput Sanger and pyrosequencing strategies and efficient bioinformatics platforms for assembly and gene annotation had to be established. Over 7 billion bases of whole and gene-enriched maize genome were sequenced and approximately 50 000 maize genes (excluding those encoded by transposable elements) were characterised. More recent projects include the sequencing of the transcriptome of chilli peppers, the fungus *Trichoderma atroviridae,* agave and avocado, as well as LANGEBIO's participation in an international programme for sequencing and annotation of the complete genome of *Trichoderma viridae* and *Trichoderma atroviridae*. Global gene expression analysis of drought-tolerant and fertiliser-use-efficient maize varieties is also under way.

The LANGEBIO initiative has so far been a success. The federal and the Guanajuato state governments have responded positively to a bottom-up initiative. An impressive scientific infrastructure has been developed and a world-class research team assembled. It has created new knowledge with important patented applications in the health, agriculture and industrial areas. This infrastructure is also contributing to the provision of technological services to enterprises and facilitating the development of a biotechnology cluster in Guanajuato. However, owing to budgetary constraints, the investment in facilities, equipment and human resources is progressing at a slower pace than anticipated. Longer-term financial commitment has to be secured to support the priority given by Mexico to biotechnology as an important component of economic and technological development in the PECITI.

1. Drs. Luis Herrera, Jean Philippe Vielle, Alfredo Herrera and Octavio Martínez.

In Mexico, with the exception of the SNI and projects funded by the Education/ CONACYT Fund, *ex post evaluation* of the results of research activities is rare. Too often it merely involves checking that the operating rules have been respected and budgetary control. Evaluation needs to be developed in line with best practices in other OECD countries. The counterpart of autonomy and increased resources is greater *social and economic accountability*. *Ex ante* evaluations of project submissions should follow best practices of peer review involving international experts, and *ex post* assessments of outcomes should affect future funding patterns.

3.4.6.3. S&T infrastructure and decentralisation

The development and maintenance of advanced scientific and technological infrastructure has long suffered from low priority and limited sources of funding, in part owing to severe budgetary restrictions. Only recently has this situation begun to change, with a doubling of federal investment between 2002 and 2006. This has helped to facilitate the decentralisation of S&T capacities. The current trend to link the granting of increased institutional resources to PRCs and HEIs, at least in part, to a regionalisation of their facilities should be maintained if not reinforced. The financing of S&T infrastructure should be an integral part of planning and budgeting public investment in S&T, especially when a larger part of resources for research projects is to be allocated through competitive funding processes.

More account should also be taken of the possibility of states' contributions to physical infrastructure and to the value added by other scientific facilities when developing local centres of excellence. The respective efforts of the federal and state levels will of course differ depending on the states' levels of development. As state governments receive larger budgets under the recently implemented fiscal reform, their participation in the financing of S&T infrastructure and projects should probably increase, at least in the most developed states. In a number of instances, state governments have indeed contributed funding in addition to the federal resources endowments. An emblematic case is the CINVESTAV National Laboratory of Genomics for Biodiversity (LANGEBIO) established in 2005 in the State of Guanajuato with joint funding from the state, CONACYT and the Ministries of Education and Agriculture (Box 3.4).

3.4.6.4. Reforming the SNI: a long-term challenge

As noted earlier, without the creation of the SNI in 1984, centrally managed by CONACYT and financed on its budget since 2002, the level of excellence of Mexico's research activities and the number and diversity of internationally recognised researchers would not be what they are today. However, if it remains unchanged, this unusual system, which absorbs a third of CONACYT's budget, may present long-term risks. While its role in developing a high-quality research base and ensuring the attractiveness of research careers should be preserved, reforms are needed to address the nature of the evaluation criteria used, the management and funding of the system, and the dangers of an ageing research community. In the longer term, the reform process could lead to the adoption by research institutions of remuneration patterns based on nationally defined standards:

- First, the *criteria of excellence* should not be restricted to scientific publications but should include contributions to research-based innovation developed either in research institutions or in collaboration with the private sector.[62] There are welcome initiatives in that direction. More credit might be given to research work

carried out in international teams or networks, and the links between collective research and individual rewards could be reconsidered.[63]

- Second, *financial rewards* in the form of a non-taxable complement to remuneration should eventually become part of researchers' regular salary once they have been confirmed at the same SNI level over a certain period. This is obviously a delicate issue with important budgetary consequences in terms of pension provisions and would require changes in labour laws governing public servants as they apply to SNI members.[64] It would change the salary scales of researchers in public research institutions and help deal with the pension issues that contribute to the ageing of the researcher community. It would also be in line with a reform that would give researchers teaching responsibilities beyond those related to the training of postgraduates. While the obstacles are daunting and such changes would be difficult to implement in the short to medium term, there is no reason why Mexico's practices should be so different from those of other countries with a strong scientific base.
- Third, while *selection procedures* might continue to be centrally managed to avoid moral hazards, evaluation committees should increasingly include members of the international scientific community. The increased costs could be compensated by reducing the frequency of evaluations relating to promotion to higher SNI levels. The inclusion of expatriate Mexican scientists in evaluation panels is a good move in this respect.
- Finally, in a longer-term perspective, the possibility of moving towards a more decentralised system in which the management of rewards would increasingly be devolved to the research institutions themselves, which have an incentive to promote the quality and relevance of their research, should not be excluded. The management of the system would remain with the institution with oversight responsibility for a research base defined by its excellence and social relevance. Funding, however, would come from government bodies with responsibility for personnel. In this case, the Ministry of Education would eventually incur most of the costs and would either transfer resources to CONACYT or make disbursements according to the results of evaluation procedures overseen by CONACYT.

3.4.7. Development of human resources

In spite of the instability of its STI policy over the last two decades, Mexico has maintained its efforts to develop skilled human capital. As illustrated in Table 3.3, this is the area that receives by far the largest amount of funding in CONACYT's budget. These efforts have paid off in some respects even if the achievements need to be put in perspective given the small percentage of students enrolling in tertiary education. Mexico's share of science and engineering graduates in all newly awarded tertiary degrees is above the OECD average; the number of doctorates awarded, while quite small by international standards, has doubled since 2000 and more than trebled in engineering and technology.

These efforts need to be maintained and expanded, but the attention to supply needs to be complemented by efforts on the demand side, as envisaged by the PECITI.

3.4.7.1. The postgraduate scholarship programme is bearing fruit

In one form or another, this programme has been in existence since the early 1980s and, through a continuous learning process, its operation and administration have gradually improved. To date it has benefited more than 150 000 students[65] and it is currently the most important source of funding for Mexicans interested in pursuing postgraduate studies either in Mexico or abroad. In recent years the number of scholarships has increased and they have been more regionally balanced. In the current budgetary context, however, the number is levelling off, particularly as concerns scholarships for postgraduate studies abroad.[66]

This programme has demonstrated its usefulness but may nevertheless call for improvements in terms of its financing modes, selection criteria in terms of scientific disciplines, and likely imbalances in the labour market for scientists and engineers. The introduction of a greater degree of selectivity in CONACYT's scholarships may be in order. Some states have developed similar programmes and tend to award scholarships in disciplines related to their areas of comparative advantage or to areas they wish to strengthen. This approach should be emulated at the federal level. With the use of improved prospective methods, an effort should be made to anticipate possible imbalances in supply and demand for human resources for S&T, notably in strategic areas that benefit from R&D and innovation support programmes. Concurrently, information surveys on the professional trajectories of scholarship beneficiaries should be developed to provide indicators which can be included in the existing National System of Evaluation of Quality of Postgraduate Studies.

3.4.7.2. The Excellence Postgraduate Programme[67]

In a context of rapid growth of enrolment in postgraduate studies in a country with a strong tradition of autonomous HEIs, quality control of training is of utmost importance. In 1991, under the aegis of the Ministry of Education, CONACYT launched the National Postgraduate Programme to ensure and enhance the quality of postgraduate studies. HEIs' postgraduate programmes were assessed with a view to organise a Register of Excellence, and scholarships are granted to all students enrolled in registered programmes. In 2006 of the 183 HEIs offering 614 doctoral programmes only 37% (214) were registered in the Excellence Postgraduate Programme.

It can be argued that to ensure a better link between academic training in S&T disciplines and the needs of the labour market for highly skilled personnel, industry representatives could participate in evaluation of postgraduate programmes. Surveys could also be regularly undertaken to monitor the career paths of students who received scholarships.

3.4.7.3. New initiatives in support of the mobility and insertion of HRST

The recently introduced IDEA programme fosters the insertion of highly skilled S&T personnel (at master's and doctorate levels) in enterprises. It lowers hiring costs by granting scholarships to participating personnel and is a sound initiative. It is however too soon to evaluate its results and to determine whether the chosen mode of financing

(scholarship) is the most appropriate for ensuring the sustainability of S&T employment in the private sector, as compared to instruments used in other countries.[68]

CONACYT and some state governments also provide continuous training stipends to allow enterprises' skilled personnel to update and develop their qualifications by taking a leave of absence from their employers to take training courses in HEIs or public research centres. More flexibility should be introduced in these programmes to better adapt the training periods and curricula to the needs of the candidates and the requirements of the enterprises.

Mobility from public research institutions to the private sector, even for relatively short periods, is still hindered by regulatory or legal obstacles related to the civil servant status of these institutions' personnel.

3.4.7.4. Attraction and retention of expatriates and foreign talent

Unlike countries such as India or China, portrayed as able to benefit from the inflows of former expatriates, mostly from the United States, Mexico's capacity to do so seems rather modest; similar conclusions would apply regarding attraction of foreign highly skilled workers to the country.

The Programme in Support of Science in Mexico (PACIME)[69] launched in 1991and financed by a World Bank loan matched by the Mexican government included a facility to invite Mexican doctoral graduates from foreign institutions and interested Mexican and foreign scientists working abroad for permanent or medium-term stays in Mexico.[70] This facility was very successful in the 1990s. Not only did it attract a significant number of Mexican and foreign doctoral degree holders (mainly from the Soviet bloc), it also encouraged national state universities desiring to enhance their research capacities to enlist the services of these repatriates and foreigners. Unfortunately, this apparent success was short-lived.[71]

In 2003 CONACYT set up the Institutional Consolidation Programme (PCI)[72] which included support for postdoctoral stays, repatriation and retention, and some mobility for Mexican scientists abroad. However, budget constraints and the priority given by CONACYT to other human resource development programmes have resulted in extremely slow progress. Yet, there is little doubt that in light of the rapid internationalisation of science and innovation networks Mexico should step up its efforts to attract foreign scientists to its public research institutions beyond current actions in the framework of bilateral scientific co-operation agreements.

3.4.8. Policy fragmentation and co-ordination failures

Well-meant efforts under the PECYT to make STI policy more coherent through better adapted institutional set-ups and support programmes suffered from problems of *co-ordination, dilution of responsibilities and fragmentation* of often underfunded programmes, especially those jointly funded and managed by CONACYT and sectoral ministries. The roots of the problem are many:

- A main problem is the fact that support programmes were designed and implemented less according to policy objectives based on a sound diagnosis than as a result of compromises regarding management and funding responsibilities between CONACYT and sectoral ministries and/or state governments. Such a situation is bound to generate significant inefficiencies due to transaction costs,

administrative rivalries and bureaucratic obstacles, with the programme beneficiaries as the ultimate victims.

- Necessary compromises between government bodies that jointly fund and manage support programmes often lead to the definition of operating rules or selection criteria that reflect a multiplicity of objectives, some open, some hidden.[73] A one-to-one correspondence between objective and programme or financial instrument is generally preferable for efficiency and effectiveness reasons.
- Many support programmes lack the critical mass needed to be effective. When resources are scarce and there is an objective need to reach compromises among agencies or ministries jointly involved in policy design, funding and management, as was and still is the case in Mexico, compromise leads to fragmentation and underfunding of individual programmes supporting STI activities, with many eligibility criteria and very cumbersome decision-making procedures.
- Discretionary procedures that govern the selection of projects and the absence of transparency as regards administrative and technical decision criteria often lead to lack of visibility of support programmes and opportunistic behaviour of stake-holders applying for support.
- Finally, there is confusion between the different functions of policy design, programme funding and programme or financial instrument management. These distinct functions call for different types of political, administrative or technical responsibilities but are too often concentrated in the same government bodies in Mexico.

3.4.9. An unbalanced policy mix

In most countries the governance structure of STI policy and the relative power of major stakeholders (*e.g.* government agencies, research institutions, academic and business sectors) influence the mix of financing instruments and funding programmes designed to enhance the performance of the innovation system. This influence has been, and continues to be, particularly strong in Mexico. Against the general background of limited budgetary resources for S&T, governance issues concerning the respective roles of CONACYT and other ministries and their co-ordination in the design and implementation of STI policy have strongly affected the mix of programmes and instruments in support of STI and resulted in imbalances. Some of these imbalances are being corrected in the framework of the PECITI, others may call for governance reforms.

As seen in Section 3.3, the allocation of the S&T budget among main policy areas reflects these imbalances which also reveal the difficulties for better orienting these resources to meet the challenges faced by the STI system, in terms not only of relative amounts of resources but also of the choice of support instruments and the criteria attached to the granting of public funding.

The development of human resources for S&T, mainly funded by the Ministry of Education and CONACYT, remains the major component of the policy mix in quantitative terms. This certainly corresponds to an objective and well-founded priority. Through purely mechanical effects, the financing of the SNI is bound to absorb a larger share of resources devoted to this area. As highlighted above, a reform of the present financing scheme should eventually be considered.

The policy mix in support of public research raises questions of level and delivery of support. Overall resources devoted to basic research have been stagnating and should increase, but the increase should be subject to changes in allocation procedures both for institutional and competitive funding to reflect performance criteria for the former and excellence and an emphasis on collaboration for the latter. Support to problem-oriented research is relatively better endowed and, through the establishment of performance agreements and increased management autonomy, efficiency improvements have been achieved. However, despite the orientations of the PECYT and maintained in the PECITI, the financing of public research suffers from a lack of dedicated programmes with credible critical mass focused on strategic technologies.

It is in the area of *support to business R&D and innovation* that the policy mix imbalances are the most striking. Taking the budgetary costs of fiscal incentives into account, this is the area in which the amount of support has increased fastest but also where the policy mix has been most distorted *vis-à-vis* the types of market or systemic failures that public support was intended to address.

The most important bias was until recently the disproportionate share of indirect support in the form of fiscal incentives. It is clear, for the reasons given in Section 3.4.3, that a better balance should be struck between direct and indirect support. The introduction of the new R&D and innovation stimulus package is therefore a welcome move, even if as presently organised it may suffer implementation problems. If a new fiscal scheme compatible with the IETU is to be introduced its design and management should be substantially improved along the lines presented in Box 3.1.

Other biases relate to the absence of dedicated programmes in areas in which business S&T and innovation capacity and/or its contribution to the performance of the STI system are weak. The most noteworthy deficiencies in terms of funding and/or design are in the following areas:

- Support to medium-term collaboration in R&D and innovation activities between enterprises and public research institutions, notably if public/private partnerships are insufficiently used to strengthen linkages between science and industry. AERIs programmes should be stepped up and consideration given to their complementarity with PROINNOVA.
- Support to new technology-based firms does not get the policy attention and support it deserves. As mentioned, support to science-based innovation activities is available through existing schemes such as AVANCE, and possibly now INNOVAPYME. But, in the absence of effective seed and venture capital markets, a specific support scheme should explicitly foster the creation and/or development of high-technology firms or spinoffs from public research institutions.
- Many OECD countries or regions pursue active public procurement policies as a way to encourage enterprises' innovative capacity and better respond to pressing social needs in areas such as health, environment, energy, education and transport. In Mexico, such policies are essentially inexistent, and this is rather surprising. As the experience of other countries illustrates, active public procurement policy at both national and regional levels, compatible with international trade rules, can be a potent driver of innovation and strengthen public/private collaboration in submissions to public tenders for social infrastructure, and goods and services with a high technological content.

3.5. Moving towards more efficient innovation policy

"As the economic crisis continues to unfold around the globe …innovation will be one of the keys to emerging from the downturn and putting countries back on a path to sustainable – and smarter – growth" (OECD, 2009). This message from the OECD Innovation Strategy project takes on particular relevance for countries which, like Mexico, have lagged in harnessing the benefits of science and technology to foster productivity growth, maintain their international competitiveness and meet social challenges. Governments are likely to assume a larger role in steering economies out of the crisis in the coming years through stepped-up public investment, support measures and incentives that aim at compensating for more risk-adverse behaviour by private actors by leveraging business investment in innovation-related activities. STI policy is thus an integral component of a strategy to deal with the crisis and lay the foundation for recovery. As public resources get scarcer, policy efficiency becomes more crucial. It should be underpinned by inter-ministerial co-ordination across areas that impinge upon innovation performance, sound governance, effective delivery and evaluation processes.

3.5.1. Guiding principles

3.5.1.1. Political commitment

Reaping the economic and social benefits of investment in science and technology takes time. Therefore, sustained political commitment and the social visibility of the benefits to the economy and society as a whole are essential to a successful S&T and innovation policy. There are no examples of developed or emerging countries that have succeeded in putting knowledge and innovation at the core of their development strategy without such a long-term commitment.

In Mexico, this commitment has too often not been sustained. The objective of a ratio of R&D to GDP of 1%, to be achieved by the end of the previous administration, was not reached. It may have been unrealistic, but for the main stakeholders it was at best a missed opportunity, at worst a lack of political commitment. The present administration has made a similar commitment in the PECITI, and in 2008, the S&T budget was increased significantly. This commitment needs to be maintained over time by the executive and legislative branches of government, and the scientific, economic and social outcomes of increased public investment should be highlighted in due course in the public debate.

Political commitment also involves consensus building when determining national priorities and setting oversight processes to ensure that these priorities are effectively addressed in the design of innovation policies and reflected both in budgetary appropriations and institutional arrangements for policy implementation.

3.5.1.2. Policy efficiency: guiding principles

Efficient use of public funds to meet economic and social challenges is an element of sound budgetary management. Public resources for scientific and technological development compete with other current or investment expenditures in areas that are often perceived as having higher or more immediate priority. Resources for the alleviation of poverty and the development of social and economic infrastructure put strong pressure on the budget. While fiscal reform can open new margins of manoeuvre,

budgetary constraints are becoming more stringent due to the economic downturn and the fall in oil prices. The opportunity costs of public resources devoted to S&T policies and their legitimacy for addressing market and systemic failures must therefore be fully justified by appropriate accounting of expected economic and social returns and *ex post* evaluations.

The strategic orientations of the 2001-06 PECYT responded to a sound diagnosis of the main weaknesses of the Mexican STI system. However expectations raised by this programme remained largely unfulfilled. They highlight failures, as well as partial successes, from which lessons can be drawn to formulate guiding principles for the design, governance, funding and implementation of STI policies in the framework of the PECITI. These principles are inspired by best practices in more advanced countries, taking into account the specificities of the Mexican situation and the transition out of the current economic downturn that calls for more innovation-based growth patterns.

- *Effective governance*. A prerequisite is political commitment at the highest executive levels of government regarding adequate budgetary appropriations in support of STI activities. This commitment should also be reflected in the operation of the governance structure entrusted with the preparation of the S&T budget in accordance with the Federal Budgetary Law, the steering of STI policy and its co-ordination with major stakeholders, including relevant ministerial departments whose actions impinge on the framework conditions that affect the performance of the STI system. Congressional committees on competitiveness, S&T and budgetary appropriations should also play a more important role in the monitoring and funding of S&T policy.

- *Effective and transparent priority setting* should be achieved through the involvement of all major stakeholders, including the scientific and business communities and the civil sector. Outcomes should be reflected in planning and budgeting documents submitted by the government to the legislative branch and widely disseminated to the public upon approval.

- *Dynamic balance between public and private resources devoted to R&D and innovation.* A condition for improved innovation performance by the private sector is access to and collaboration with the public research system funded on the basis of criteria of excellence and relevance of research activities.

- *Clarification of functional responsibilities.* Following international best practices the political bodies responsible for defining priorities and for policy design should be distinct from agencies in charge of policy implementation, the latter being accountable to the former.

- *Single agent management.* While co-ordination of various government bodies or different levels of government is necessary for policy design and/or programme funding, single body management of implementation is generally preferable to arrangements involving joint management and funding. These usually entail high transaction costs and complicated or even antagonistic decision-making processes.

- *Critical mass and lean procedures in the delivery of government support.* Multiplication of programmes should be avoided. This often reflects opacity in policy design, response to vested interests and/or overlapping responsibilities among government agencies. Moreover it often involves high administrative costs, inefficiencies in delivery and can lead to fragmentation and programmes of less

than critical mass. The devolution of management responsibility for mixed funds to states addresses this issue. Sectoral funds that reflect strategic priorities should, to the extent possible, be funded and managed according to unified operating procedures.

- *Balanced policy mix.* The policy mix should reflect the importance of various policy priorities and the critical mass necessary for effective programmes. For support to business R&D and innovation, the policy mix should strike an appropriate balance between direct (e.g. matching funds) and indirect support measures and sectoral support and take better account of the types of market or systemic failures these measures can address. In the case of support to public research institutions, it should strike an appropriate balance between institutional and competitive funding while encouraging access to external resources.
- *Balance between top-down and bottom-up approaches.* Stakeholders such as intermediary institutions and state bodies can contribute more to the definition and implementation of programmes that benefit their constituencies. Good practices already adopted (e.g. technological infrastructure, technological clusters, AERIs) should be generalised when appropriate.
- *Evaluation and accountability.* Regular evaluation of support programmes and institutions receiving public support should become the norm, with practical consequences for further rounds of support. However, a balance must be struck between the need for periodic adjustments based on evaluations and the stability of support programmes to ensure their long-term impact on the behaviour of beneficiaries. Regular audits should also check that budgetary appropriations earmarked for S&T are effectively spent in that area.

3.5.2. Improving governance structures

Throughout this chapter it has been emphasised that, in spite of CONACYT's authority with respect to the objectives of the PECYT, the low levels of resources devoted to S&T/R&D during the preceding administration, together with the dispersion of budgetary and management responsibilities, resulted in ineffective governance and a distorted policy mix of a large number of often under-funded support programmes. Measures to strengthen Mexico's innovation system will only succeed if they are part of an effective overall governance system that adheres to the principles detailed above.

Given Mexico's institutions and the principles that apply to its government structure, flexibility is limited and there is no silver bullet to improve the governance of the STI system.

The creation of a Ministry of Science and Technology (or of Higher Education, Science and Technology), a common practice in OECD countries, would in principle be worth considering. Such a ministry would be in charge of policy design and entrusted with the power to co-ordinate the whole of the S&T budget and oversee government agencies responsible for policy implementation. CONACYT legitimately aspired to fulfil that function[74] but was not given the means and was not in an institutional position to do so.

However, the creation of a new ministry seems unrealistic at the present time. Furthermore, it is politically unlikely that the power that was denied to CONACYT for the PECYT would now be ensured by granting it ministerial status, especially since it was recently decided to make the Minister of Economy the chairman of CONACYT's Board.

The creation of a new ministry should nevertheless remain an option for future consideration. In the near term the most feasible option is an inter-ministerial council chaired by the president and including ministers with management and budgetary responsibility for S&T programmes or institutions.

3.5.2.1. An effective S&T inter-ministerial council

The General Council of Scientific Research and Technology Development established in the framework of the 2002 S&T Law and chaired by the President of the Republic met only three times in the past six years. To be effective an inter-ministerial council should not only be formally entrusted with defining national priorities and ensuring inter-departmental co-ordination of S&T policy orientation and national support programmes: it should exert these responsibilities and be involved in the preparation of the S&T budget. The General Council, whose existence was maintained in the current revision of the S&T Law, could assume these responsibilities if there is a political commitment for it to do so at the highest level, that of the Presidency. In particular, the Council:

- Should have real influence – or at least a consultative say – regarding resource appropriations (including all S&T resources beyond those of Chapter 38), and possibly resource transfers between the federal and state levels. Its oversight responsibilities should also encompass regulatory policies that impinge upon the performance of the STI system, via legislative proposals or a consultative role regarding the impact on innovation of key framework conditions such as competition policy or labour regulations. In this respect it would seem important for the Council be in a position to review the provisions of existing laws and regulations (*e.g.* the Law on Parapublic Entities, the Law on Public Procurement and the Labour Law) that may presently hinder the efficiency of public research institutions and, more generally, may adversely affect the performance of the S&T and innovation system. In fact, for the new law on science, technology and innovation to have a real and lasting impact would require other legislative or regulatory changes as well.
- Could be assisted by a tripartite S&T consultative board composed of representatives of the scientific and business communities and intermediary institutions. The existing Advisory Forum for Science and Technology (FCCyT) instituted by the S&T Law could in principle perform the functions of such a body, but its role and composition should be reconsidered. One the one hand, its membership should be better balanced between representatives of the academic and the industrial sectors;[75] on the other, it should better manage its dual role of advocacy for S&T and innovation and consensus building among the stakeholders it represents.
- Would be expected to meet at ministerial level at least twice a year to address strategic issues concerning S&T policy and their consequences in terms of budgetary appropriations and legislative or regulatory action. More frequent meetings at lower levels would be devoted to inter-ministerial co-ordination and monitoring of policy implementation.

In addition, and in order to acknowledge and enhance the role of S&T and innovation in Mexico's social and economic development, CONACYT could also become a full member of the Government's Restricted Cabinet which deals with economic matters and competitiveness.

In this institutional setting, S&T planning and budgeting would be distinguished from financing and implementation of competitive programmes, with the latter performed by "means" or financing agencies. However, non-competitive forms of financing would continue to be assured by sectoral ministries, for example mission-oriented STI programmes or projects executed in the research institutions under their authority, or the institutional funding of basic research by the Ministry of Education.

CONACYT and the Ministry of Economy would be entrusted with particular responsibilities not only as the main government bodies responsible for policy implementation and programme funding, but also because of the complementarity of their actions in support of R&D and innovation at the interface of scientific and technological development. The question of their respective roles is therefore important for the governance of the STI system.

A clarification of the roles of the various bodies, ministries or specialised agencies, endowed with S&T budgetary resources would facilitate the necessary streamlining of support programmes and simplify the criteria for support allocation.

3.5.2.2. An evolving role for CONACYT

In order to ensure stability and avoid the disruptions associated with the current practice of rotating chairmanships, the Minister of Economy should chair the CONACYT Board on a more permanent basis. In addition to its role in the overall co-ordination of S&T policy, which could be strengthened if its director general reported directly to the president, CONACYT would evolve into a "means agency" with the following main responsibilities:

- Management of competitive funds to finance R&D-intensive projects or programmes:
  - The *Basic Science Fund* for non-oriented research performed by public research institutions.
  - A limited number of *sectoral funds* in areas corresponding to national technological or sectoral STI priorities and devoted to the financing of medium-term applied R&D and innovation programmes submitted by public research institutions and/or industrial associations. While CONACYT would be responsible for the management of these funds, ministries with administrative responsibilities for the priority sectors would be involved in programme definition and evaluation of outcomes. Part of the resources allocated to these funds would be explicitly devoted to the medium-term financing of public/private research and innovation partnerships (consortia and AERIs). A condition of the effective management of these funds would be a streamlining of the bureaucratic decision and disbursement procedures.
  - The *AVANCE institutional fund*, whenever projects are presented in collaboration with public research institutions.
  - The new *R&D and innovation stimulus package.*

- Management of the interface with sub-federal entities for the development of STI capacities:
  - programming and co-financing of *mixed funds* according to national and regional priorities with particular attention to the development of S&T infrastructure for regional innovation systems and technological clusters, with increased devolution of project selection and management to the states.
- Public research centres:
  - CONACYT would continue to oversee and fund the institutional component of its research centres while encouraging their greater management autonomy (including further progress towards self-financing), closer links with HEIs, or even possible partial or total privatisation for those that primarily provide services.
- Human resources for S&T:
  - management of the National System of Researchers and of its reform and transition towards a mixed system of centralised evaluation and decentralised compensation;
  - management of the postgraduate scholarship and the IDEA programme.
- Fiscal incentives:
  - The re-establishment of an R&D fiscal incentives scheme with new modalities and consistent with the IETU should be considered in the future. In this case, CONACYT should jointly manage the reformed scheme with the Ministry of Finance, with particular responsibility for information dissemination, procedural support, *ex post* control and monitoring and evaluation.

Finally, CONACYT would also maintain its oversight and financing responsibilities for the programmes aimed at enhancing international scientific co-operation (FONCICYT).

3.5.2.3. The role of the Ministry of Economy in the promotion of innovation for competitiveness

The Ministry of Economy plays an important role in fostering competitiveness and, like ministries with similar responsibilities in most OECD countries, it should move towards increased emphasis on the promotion of enterprises' innovation capacity building and technological infrastructure. Its actions could be organised along the following lines:

- Technological Innovation Trust Fund:
  - This fund would cover the missions presently attributed to the Economia/ CONACYT Technological Innovation Fund and support innovation projects submitted by firms, essentially SMEs. Support would be granted through matching funds or grants. Eligible investment expenditures would include R&D costs and technological infrastructure (*e.g.* ICT, logistics, metrology, certification, IPRs). Projects should be assessed on the basis of expected returns and supported irrespective of sectors or technological area. The only conditions of eligibility should be related to a project's constraints[76] on developing economically viable innovative activities. The only discriminating

factor among projects could be preferential treatment for those carried out in co-operation with PRCs or HEIs.

  - The fund would develop links with the financial sector through its contribution to the development of venture and seed capital funds and guarantee funds in co-operation with NAFIN. Like innovation agencies in various OECD countries, it could also provide special incentives for the creation of new technology-based firms.[77]

- Technological infrastructure and diffusion:

  - In liaison with institutions such as INFOTEC, CENAM and IMPI, the Ministry of Economy should develop or strengthen its support for technological infrastructure and diffusion programmes submitted by intermediary institutions or industry associations, notably for the development of innovation clusters and productive networks. In this important area of promotion of regional innovation capacities, strong co-ordination with CONACYT would be required.

Finally, the Ministry of Economy should be endowed with adequate resources for emulating the PROSOFT programme in other priority technology areas, provided that the support is complemented by funding from other sources, including firms, intermediary institutions and local governments, and contributes to the development of sectoral and regional clusters.

3.5.2.4. Improving the articulation between the federal and state levels

Governance reforms should also concern the design, management and financing of policies and programmes that aim at strengthening STI capacities at state and local levels.[78] This raises several questions.

Co-ordination mechanisms between the federal and state levels which involve CONACYT and state S&T councils should be reinforced with a view to identifying projects that correspond to national priorities, and therefore call for a larger share of federal funding, and those that correspond to state priorities, and therefore imply differentiated shares of funding, especially in light of the fiscal reform that increases resource transfers. The more strategic approach currently adopted by CONACYT in the definition and design of projects selected for funding is a good step in that direction which deserves to be developed further.

As noted above, the management and effectiveness of mixed funds have quite often been impaired by lengthy selection and disbursement processes, and, in a number of states, by weak capacity to develop and submit adequate R&D and innovation proposals. The supply/demand balance of mixed funds should be modified to give states more management responsibility for funds allocated to institutions located in their territorial jurisdiction. Decentralisation of policy should be accompanied by decentralisation of management[79] and, to a larger extent than is now the case, by decentralisation of resources. This would greatly reduce the administrative burden borne by CONACYT, as mixed funds would eventually merge with, or contribute to, the state S&T budget for financing projects presented or led by local institutions. The shifting balance of management and financing responsibilities between the federal and state levels would obviously not be the same for all states.

As concerns the strengthening of S&T capacities of less developed states, a mechanism similar to the European Union's Structural Funds for overcoming regional disparities in terms of infrastructure would deserve consideration by the Congress.[80]

3.5.2.5. Evaluation

Finally, good governance implies regular evaluation exercises with feedback on policy design and financing. In Mexico an embryonic culture of evaluating outcomes has to be further developed, as too many policy assessments tend to be simply a description of resource allocation, a check that procedures have been respected, and sometimes consideration of the quality of management. Too often issues of the effectiveness of the policy instrument *vis-à-vis* its stated objectives and its cost effectiveness are not addressed. Following practices increasingly implemented in other countries, CONACYT and other ministries responsible for the funding of S&T and innovation programmes or projects should develop monitoring and assessment systems based on qualitative and quantitative information and indicators. The rationale of support programmes as well as the expected outputs and outcomes should be highlighted at the outset. Monitoring and *ex post* assessments should provide feedback on policy design and funding.

Notes

1. Mexico's relatively good record in the training of engineers can be traced back to the creation of IPN.
2. The Ministry of Planning and Budget was suppressed in 1992 and responsibility for CONACYT was transferred to the Ministry of Education.
3. In particular the Autonomous University of Mexico (UAM).
4. The National Programme for Technological and Scientific Development (1984-88); the National Programme for Science and Technological Modernization (1990-94): and the Science and Technology Programme (1995-2000).
5. The Ministry of Education with oversight of CONACYT and HEI, and sectoral ministries with oversight of research institutes in their areas of responsibilities.
6. FIDETEC's principal objective was to encourage private business to invest in R&D activities considered highly risky but promising. CONACYT funded these projects in their first stages (conception and prototype). FORCCYTEC was a fund to support the creation of private R&D centres to strengthen industry's technological and innovative capabilities. PREAEM promoted university-industry links which supported research projects of mutual interest. PIEBT's main aim was to support start-ups. CONACYT provided seed capital and space to incubate the start-up in its first stages, along with management advice and training.
7. Changes were only introduced in 2008. They concern the modification of evaluation criteria to take better account of innovation performance (not only scientific excellence) and the periodicity of the reviews to which researchers are submitted.
8. However, sectoral ministries such sat the Ministries of Economy, of Health and of Agriculture retained an important role in the funding and management of specific programmes as well as, for the latter two ministries, the oversight of public research centres.
9. With the exception of the fiscal incentive which became more important over time.

10. As emphasised by a panel of international experts entrusted with the evaluation of Mexico's R&D and innovation policy 2001-06: "While the PECYT represent an initiative that addresses Mexico's challenges in an appropriate manner, neither the global articulation of the strategy, nor the rhythm of implementation of new support instruments, not the portfolio of instruments at the disposal of CONACYT have been satisfactory…This situation compounded by the weaknesses of the institutional model of co-ordination and governance of the STI policy has generated difficulties to prioritise effectively the actions that would foster a better articulation of the whole system." ADIAT/CONACYT (2007).

11. The present review is part of this process. Its overall assessment and recommendations were made available to the Mexican authorities in the summer of 2008 and formally presented in Mexico by the OECD Secretary General on 26 September 2009 on the occasion of the approval of the PECITI by the General Council chaired by Mexico's President. These assessment and recommendations were presented to a wider public of STI stakeholders at the 1st Forum on Innovation organised by CONACYT and the ministry of Economy in January 2009. The FCCyT and the ADIAT/ CONACYT studies have also contributed to the assessment process. See FCCyT (2007) and ADIAT/CONACYT (2007).

12. The degree of autonomy is determined to a significant extent by the President of the Republic. The appointment of CONACYT research centres' directors also remains a prerogative of the President. This generates credibility issues for firms and other entities in terms of engaging in co-operation projects and agreements with the centres.

13. To date, however, PRCs patent little. Only the Mexican Institute of Petroleum (IMP) and the Electrical Research Institute (IIE) have patented significantly over the last several years.

14. The Ministers of Education, Foreign Affairs, Economy, Health, Energy, Environment, Agriculture, and Communications and Transport.

15. This is an important issue in many countries, but probably more so in Mexico with its pyramidal structure of executive power.

16. The chair changes periodically and is presently held by the Minister of Economy.

17. Less than 20% if the financing of the PRCs is included. Around two-thirds of its budget goes for support to human resources in S&T (*e.g.* financing of the SNI and the scholarship system). In 2006 the total budget administered by CONACYT was USD 508 million, or 17% of total federal expenditures in science and technology.

18. Foregone revenues related to R&D fiscal incentives are not included in the federal S&T budget.

19. In particular UNAM, CINVESTAV, IPN and UAM. The greater share of institutional funding goes to the payment of salaries.

20. Formerly, the Ministry of Energy funded some research activities of PEMEX but no longer appears to do so.

21. Such as the National Institute of Public Health (INSP) and the National Institute of Cardiology.

22. Moreover, whereas CONACYT research centres are fully accountable and must enter performance agreements this is not the case for most other public research institutions under sectoral ministries.

23. From MXN 9 870 million in 2002 to MXN 10 282 million in 2006 (at 2006 prices), with small upwards and downwards variations in the intervening years. CONACYT's budget started growing again in real terms in 2008 with a 14.8% increase over 2007.

24. The number of SNI members almost doubled from around 7 500 in 2000 to over 14 500 in 2007.

25. In 2006, 72% of accepted projects involved only one researcher.

26. There are ten research centres in exact and natural sciences and eight in social sciences and humanities.

27. The Technological Innovation Fund, previously called the S&T Fund for Economic Development.

28. With a further increase to a ceiling of MXN 4.5 billion in 2007 and 2008.

29. Support for the development of innovative clusters provided by the Ministry of Economy is not included in the S&T budget.

30. In the Mexican government system, the term "sector" as it relates to sectoral funds refers to the area of a ministry's administrative responsibility, not to a field of economic activity.

31. 15 sectoral priorities for the Economia/CONACYT Fund.

32. Rejection rates were above 70% for the Education/CONACYT Fund and close to 90% for the Economy/CONACYT Fund in the last two years.

33. All sectoral funds except Education/CONACYT and Economy/CONACYT.

34. Between 2002 and 2006 CONACYT's share of total expenditures in mixed funds was 59% and the state share 40%, the rest being funded by municipal governments.

35. Between 2002 and 2006 research centres and HEIs received more than 60% of the grants.

36. However, funding increased in 2008 with MXN 350 million allocated to so-called "strategic projects", with MXN 30 million minimum per project.

37. Since 2001 the number of firms and institutions accredited by the RENIECYT, which entitles them to R&D and innovation-related support, has increased more than 15-fold.

38. As well as the Ministry of Finance through its role in the determination of the ceiling of fiscal incentives and the selection of beneficiaries.

39. Although fiscal incentives are not accounted as budgetary resources, the fact that a ceiling is set and selection criteria are applied creates at least the perception of financial support, the magnitude of which affects other instruments. The situation is very different in other OECD countries with a similar instrument which they apply without predetermined ceilings.

40. Under the name "Fund of S&T for Economic Development. The name was changed in 2007 and the terms of reference were slightly changed.

41. Projects presented by large firms must involve SMEs in their proposals.

42. Federal funds allocated to PROSOFT are not included in the S&T budget.

43. In 2004, the programme budget surpassed USD 13 million. In 2005 the amount distributed increased to more than USD 18 million, and the number of projects increased from 68 in 2004 to 181 in 2005. In 2006 the volume of resources allocated by PROSOFT to software development amounted to USD 40 million distributed to more than 300 projects.

44. Calculated for international comparisons as the amount of tax relief incurred by one currency unit of R&D expenditure, according to the following "B-index" formula: $B = (1-A)/(1-t)$, where A is the net present discounted value of depreciation allowances, tax credits and other R&D tax incentives available, and t is the corporate income tax rate. In Mexico, the level of generosity was 0.37%, second only to that of Spain at 0.39% (OECD, 2007g).

45. The tax subsidy rate of course depends on the rate of the corporate income tax, not only on the rate of the tax incentive.

46. Or to deal with structural budgetary problems as in the case of tax deductions for government-issued bonds (CETES).

47. Most of them belonging to the SNI.

48. In 2007 of the MXN 4.5 billion of fiscal incentives, MXN 1 billion was earmarked for "R&D projects for alternative sources of energy and R&D projects for micro and small enterprises"; another MXN 1 billion for the development of "specialised infrastructure of research centres devoted to projects focusing on the development of products, materials or production processes that constitute scientific or technological progress". The remaining MXN 2.5 billion could be allocated to other non-prioritised projects.

49. This distortion is also likely to have led to an overestimation of business R&D expenditures in statistical surveys.

50. While 81% of eligible expenditures submitted by large enterprises were supported, the figure for SMEs was 65%.

51. Outstanding tax credits awarded before 2009 can of course be claimed in 2009 and subsequent years.

52. In Brazil it is compulsory to have TTOs or TLOs in research institutions receiving public funding.

53. The share of self-financing by CONACYT centres reached 35% in 2006.

54. In principle there could also participate in the creation of spin-offs. The cases are very rare, however, and there seems to be high regulatory barriers.

55. All CONACYT's research centres, but not all sectoral ministries' centres, have underwritten performance agreements.

56. From 1995 to 2001 the Ministry of Education funded and managed the Programme of Support of Research, the predecessor of the Basic Research Fund. Over 2002-07 CONACYT's contribution to the fund was double that of the Ministry of Education.

57. Mainly provided by SEP for HEIs, and other ministries and CONACYT for their research centres.

58. In a number of more advanced countries the criteria attempt to reflect performance and excellence (*e.g.* scientific publications, number of doctoral students, research grants awards, patents, etc.)

59. It is likely that the current high rejection rate of projects highlights the scarcity of funds more than poor quality or lack of relevance. The Mexican science system has certainly a higher absorptive capacity for basic research than the resource ceiling of the fund.

60. In order to increase interactivity in the research system, CONACYT introduced in 2002 some changes in the call for proposals in order to give priority to applications involving groups and research networks. However the results were not conclusive as the share of individual projects only dropped from 78% in 2003-05 to 72.0% in 2006.

61. The difference with the sectoral programmes initially considered in the PECYT is that they would be managed by a "means agency" and not by the sectoral ministries.

62. In the context of a desirable reform of IPR management in public research institutions, part of the proceeds of IPRs should also go to individual researchers.

63. To avoid abuses, more weight could be given to international recognition in the credit given to individual researchers participating in collaborative work.

64. One possibility is that, upon retirement, SNI members would continue to receive a fraction of their last SNI premium in their pension.

65. Including scholarships funded by sectoral ministries, mainly Education and Health. Overall, CONACYT presently funds around two-thirds of postgraduate scholarships.

66. This levelling off contrasts with Chile's active promotion of studies abroad, under the Bicentennial System for the Formation of Specialised Human Capital Abroad, which foresees a threefold

increase in the number of scholarships available for study in the best overseas universities by 2010.

67. Programa de Fortalecimiento del Posgrado Nacional (PFPN).

68. Such as direct wage subsidies to lower the cost of newly hired S&T personnel with subsidy rates declining over time, or inclusion of such wages in the R&D expenditures eligible for fiscal incentives at a premium rate.

69. *Programa de Apoyo a la Ciencia en México*.

70. The amount of the loan was USD 150 million. The programme focused mainly on the development of S&T physical and human resources infrastructure.

71. Mexico received 299 foreign academics in 1994 and only 49 in 2002.

72. Programa de Consolidación Institucional.

73. Such as the use of R&D fiscal incentives to attract foreign investment.

74. Although policy design and co-ordination were not clearly distinguished from implementation.

75. At present it has 14 representatives of the academic sector and three industry members.

76. Such as access to finance, access to proprietary technology, availability of qualified personnel, etc.

77. Eventually, this fund could become an autonomous innovation agency able to participate financially in firms it supports. In this case, it would have to receive endowments from the public sector and financial institutions.

78. The recent study, *OECD Reviews of Regional Innovation: 15 Mexican States* (OECD, 2009), provides more detailed answers to the two following main questions: How should national innovation policy take into account the regional dimension of innovation systems? How can regional actors support innovation that is relevant for their specific regional context?

79. This, as well as federal/state co-ordination, would be facilitated by more homogeneous state administrative structures regarding the administrations responsible for S&T policy and programmes.

80. The Structural Funds clearly go beyond the S&T issue. In the European Union, they have played a significant role in the catching-up process of backward or peripheral regions and have demonstrated that resource transfers aimed at improving the infrastructure of such regions can yield global benefits for the EU as a whole.
See, for example, *http://ec.europa.eu/regional_policy/innovation/index_en.htm*.