STI OUTLOOK 2002 – COUNTRY RESPONSE TO POLICY QUESTIONNAIRE

MEXICO

1. General framework and trends in science, technology, and industry policy

The Mexican System of Innovation (SMI) is formed by the private sector, the government, the advanced education institutions and the external sector. It is a fact that general lines of policy for support and development of these sectors have been clearly influenced for a better performance of the SMI. Thus, series of programmes that relate the agents that compose the system have been implanted, improving their interaction and function

The government sector is the one that has the major responsibility to do tasks that allow the efficiency of the system to increase, because this sector concentrates most of the resources, human and financial, dedicated to scientific and technological activities. Nevertheless, it is wanted that all the measures focused to increase the activity of innovation in our country can be applied in the productive sector, main actor of these activities in the OCDE countries.

This way, the government gives an institutional framework appropriate for the development of innovation in Mexico. At the present, there are several institutions of government sector that back up and protect the innovation in the productive sector, these institutions have been created or modified through the time to better fulfil the objectives that were assigned.

The main public organism of promotion and support of the activities of science and technology is the National Council of Science and Technology (CONACYT).

Consulting instance of the federal administration, dependant of the Public Education Ministry, for the activities and programmes of science and technology (CYT). It collaborates with the Federal Executive Power in the co-ordination, orientation systematisation and promotion of the activities if the CYT.

Among the activities CONACYT does, we can find the following: to establish links with international organisms which is responsible for the scholarship post-grade system and to co-ordinates the SEP - CONACYT centres whose main function is to perform scientific research and technological development. Within the various functions of CONACYT we can find the management of the National System of researchers (SNI) whose main objectives are to fortify and encourage the efficiency and quality of the research in any branch or speciality, through the support of researchers of advanced education institutions or the research centres of the public sector, as well as those that do their labour in private institutions.

The CONACYT has implanted programmes that support links among the advanced education institutions (IES), Public Research Centres (CPI) and the private sector. They try to take advantage of synergies that result from the joint knowledge of producers and human resources and those who are able to take advantage of that knowledge and those who aid in the development of the new products or processes. With

this in mind, the CONACYT has administrated the Knowledge Programme of Innovation for a short period of time under one of several sub-programmes of support to industry operate. In general terms, this programme has been successful even though it is necessary to wait longer to check its effectiveness.

There are other initiatives of the Federal Government to improve the performance of the productive sector —mainly in small and medium-sized enterprises (PyMES). In particular, the Economy Ministry created the Under Ministry for the small and medium-sized enterprises in order to promote the establishment of these kind of enterprises when identifying the potential of development that they can have, either in the economical aspect or through the generation of well paid employments.

Thus, the Economy Ministry administrates the programmes Compite and Cetro-Crece in the enterprises in which The CONACYT actively participates. Both programmes have been efficient to prepare the PyMES as suppliers of bigger enterprises, as well as to offer services and products of a better quality to final consumers. Some of these programmes have been designed to include direct participation of the productive sector in its administration.

- **Committee Programme:** (National Committee of productivity and technological innovation) It allows for the improvement of the competitive position of the micro enterprises, small and medium-sized ones through the maximisation of the performance of its resources. It is a methodology of quick intervention and theoric-practic, applicable to production problems, viable in any branch of industrial manufacturing.

- **Cetro-Crece Programme:** The private initiative and the federal government created a model of attention for the effective support in benefit of small and medium-sized micro enterprises. For these enterprises to face their present economical situation, to assure their survival and to make their growth possible, the national net of Regional Centres for the managerial Competitiveness was created of private character and non-lucrative ends.

The CRECE are operated under the supervision of the corporative CRECE, denominated Development Centre for the Managerial Competitiveness (CETRO)

With no distinction, The CRECE deal with enterprises of the commercial, industrial and service sectors because this initiative is the result of the consensus of the managerial organisms of each state. The focus of the CRECE is to give the medium-sized enterprises concrete solutions and to offer services such as:

- Integral consulting.

- Managerial training.

- Research of projects of viability.

- Market research.

- Sectorial and financial analysis.

As part of the objectives of the Special Programme of Science and Technology (PECYT), in 2001-2006 we can will find an increase of efficiency of the SMI, through the participation of the entire society. This way, the PECYT proposes to include different public and private institutions as well as propitiate the participation of individuals and the private sector for the consecution of the goals proposed by the present administration.

The Law for the fomentation of scientific and technological research (LFICyT) promulgated in April 1999 introduces fundamental changes in the way the National System of Science and Technology operates. The goal of this law is to regulate the support that the Federal Government is obliged to give in order to impulse and develop the scientific research in general in the country. Among its main objectives, we can find the following.

- To determine the instruments through which the government will support the scientific and technological research.

- To set co-ordination mechanisms among the agencies and entities of the federal public administration and other institutions that participate in policy formulation and the programmes of scientific and technological programmes.

- To link the scientific and technological research to the education.

- To regulate the application of auto-generated resources by the public centres of scientific research and the ones that third parties give for the creation of research funds and technological research.

The scientific and technological activities that the agencies and entities of the public sector perform will be directed to the identification of problem solving and challenges of general interest, to contribute to the advancement of knowledge frontiers, to increase the life quality levels in the population and environment as well as to support the formation of specialised personnel in science and technology.

Besides, under protection of the LFICyT, the operation of the Science and technology cabinet is a specified mechanism that allows the allotment of budgets in a co-ordinated way of the resources set for scientific activities in the private sector in order to determine areas of opportunity and to avoid duplication of efforts.

In regards to the recent evaluation of support policies to science and technology, our main example is the evaluation done in 1998 to the programme of support to the Science in Mexico (PACIME) along with the World Bank. This programme operated by CONACYT since 1992 searched mainly into the establishment of solid infrastructure to do projects of research and the development of technology. As a result of the evaluation, there were substantive advances in the creation of certain infrastructure in scientific areas in the academic sector mainly, with a weakness in technological areas. Therefore, in order to propitiate a better performance of the managerial sector, a series of programmes focused on the support of the activities of innovation in the private sector was designed.

Nowadays, The PECyT proposes a more balanced development between the scientific and technological areas. Furthermore, it has included measures that support the evaluation in the achievement of the goals proposed, that allow the feedback to design corrective mechanisms in case of having deviation in some of its objectives. It will be given follow-up to the indicators that are linked to the strategic objectives of the Special programme of science and Technology 2001-2006 in order to verify the degree of advance in the compromises achieved in the science and technology field. The goals for the year 2006 will be able to be checked annually and will be adjusted in accordance with the real micro-economical behaviour.

At the same time, the public research centres will control their relationships with the Federal Public Administration and the CONACyT through agreements where the performance basis are established, whose main objectives will be to improve the activities of such centres, reach more goals and achieve results.

These agreements will contain, among other basis, criteria and performance indicators and evaluation of results, and activities and projects that the organ of government approves. As these are aspects of scientific and technological field, these will be dictated by the CONACyT, which will have to call on experts in the corresponding speciality.

2. Public sector research and public research organisations[1]

One of the main compromises of the present administration is to increase the research and development expenditure from 0.4% of the GNP in the present year to 1% in 2006. To achieve this goal, it is indispensable that the public sector steadily increases the resources directed to that activity during the next years, as well as an increase in the expenditure level of the private sector. Thus, the public centres of research will be able to receive higher resources, always conditioned to the obtaining of results and satisfaction of the needs of the Mexican society and the private sector. Likewise, the research done in the universities will be favoured with a steady increase in its financing, conditioned to the human resources of high-level formation.

Among the objectives of the Special Programme of Science and technology 2001-2006 we find the co-ordination of different scientific and technological activities that are done by the agencies and entities of the Federal Public Administration. Because of this, the sectorial programmes of science and technology that will allow to achieve this objective are being formulated, so the research work in the public sector will be directed to deal with specific requirements of the society (knowledge demand). In this task it will be fundamental to impulse the diffusion of results in the public investment in science and technology.

The sectorial programmes only refer to the State Ministries of the Federal Public Administration (APF) and its research centres, if the projects of research can incorporate the advanced education institutions and or private research institutions and enterprises. For the development of sectorial programmes of CyT the execution of diagnostics and technological predictions by knowledge areas is required.

Furthermore, within the sectorial programmes, we can identify several strategic areas which must be dealt due to the importance that they hold for and around the public and private sector, the scientific and technological activities will be directed which the Government will develop. These areas of knowledge which are being developed by the different research public sectors and institutions of advanced education with capacity for research, represent the offer of knowledge for the solution of sectorial problems.

The criteria used for identifying the priority scientific technological areas were the following:

- High rate of scientific and technological change.
- Existence of high level researchers in the country.
- Impact of well being among the population.
- Impact of the scientific and technological change in the productive and social sector.
- Important base of the economical activity in the sectors that will use the innovations.

[1]. This section, especially sub-section 2.2 partly overlaps with a separate questionnaire circulated to members of the CSTP Ad hoc Working Group *on Steering and Funding of Research Institutions*. When appropriate, countries could make references to responses given to that questionnaire.

- Degree of technological dependence from exterior.
- Potential of new advances or development in the short future.
- Opportunities for the creation of enterprises of technological base.
- Impact in the increase of competitiveness of the enterprises.

From the application of the proceeded criteria, strategic areas of knowledge are considered.

- Information and communications.
- Biotechnology.
- Materials.
- Design and manufacturing processes.
- Infrastructure and urban and rural development, including its social and economical aspects.

Regarding the restructuring of the public research centres, they will have to direct their activities mainly to satisfy the demand of certain sectors in our country. They will have to direct their efforts to the achievement of several indicators of human resources formation, deal with social needs, satisfy the demand of the public and private sector, as well as in some cases, fulfil the expectations assigned by their government organs.

In the case of the net of research centres of the system SEP-CONACYT, we have found that they have gone through a restructuring in order to better fond a business plan, in such way that they plan their activities and projects with a marketing direction, identifying the demand of scientific and technological services in the field of their competence.

To facilitate the fore-mentioned activities, the present legislation allows the research public centres to have more autonomy. They have at their disposal the generated resources by themselves so that these centres will have the capacity to respond quickly to the changes that occur in the satisfaction of needs in the scientific and technological field in our country.

3. Government support for private-sector R&D and innovation

Since 1998, a fiscal credit has been given to the research and development of technology of enterprises. This mechanism is part of a strategy of the Federal Government to support such activities in the productive sector. The incentive consists of a fiscal credit of 20 % of the expenditure and increasing investment in research and development of technology (IDT) to which the enterprise will commit to during the determined fiscal exercise. Moreover, at the moment of writing this document, a new, more enterprise favourable scheme of fiscal credit, was expounded in the congress, that benefits with a 20 % of the yearly expenditure in IDT to the big enterprises and 35 % of the expenditure of small and medium-sized ones.

In addition, there is a proposal by the Federal Government to introduce a new fiscal legislation, one that reduces the fiscal charged faced by enterprises. This directly affects the investment in IDT because the enterprises will be able to have at their disposal more resources that will be given by the reduction of impositive rates so they can canalise any amount to the research and development activities.

It is reflected in the index-B that there is a measure of the fiscal opportunities that the Government gives to IDT and that according to the prediction of the revenue service ministry, the index-B would be reduced when considering the scenario proposed compared to the present one. Therefore, this would mean more fiscal support to the IDT.

Nevertheless, this reform is still in the congress of the republic subject to discussion.

Besides, there are other forms of direct support from government to enterprises involved in activities of IDT and of innovation. This is the case of several programmes administrated by CONACYT. These programmes support the technological modernisation, the link and technology development. These supports include loans at preferential rates and lost fund loans in which it is not necessary to reincorporate the loan if a series of requirements previously established are fulfilled.

Under protection of the foment law to scientific and technological research, there is a possibility of generating mix and sectorial funds in which there will be concurrent funds of the Federal Administration, of Federal entities, of the State Ministries, including private sector, through the ones the activities will be supported in CYT and the link between the agents that integrate the science and technology national system will be propitiated. With this last mechanism, the enterprises and the government will be able to establish concurrent funds in which the state will give monetary resources in proportion to the funds given by the private sector for the achievement of scientific and technological activities.

On the other hand, there is a net of centres of research of the system of centres SEP-CONACYT formed by 29 centres of research in different fields of the science. Their main objective are:

- To decentralise scientific and technological activity.
- To improve and expand high qualified human resources formation.
- To articulate the scientific activity in the country with world-wide knowledge trends.
- To contribute to the understanding of reality of national problems in the different areas of research.
- To increase and promote the technical capacity of producers in the country, to deal with well-being demands of the population.

Ten out of the 29 centres are dedicated to the research of natural and exact science, ten more to social and humanities, and nine to technological development. They are distributed all over the national territory. These centres, in particular the technological ones, do frequent link activities with enterprises by supporting in scientific and technological services and in research and development projects.

In addition, there are programmes administrated by other public entities that support the managerial innovation, like the Cetro-Crece and Compite described in the first point. As a complement, there are several government agencies that support enterprises that want to allocate their products overseas like the Bank Exterior Commerce.

4. Enhancing collaboration and networking among innovating organisations

Due to the importance that diffusion and access of new technologies have, in the SEP-Conacyt net, there is a centre dedicated exclusively to the diffusion of the new technologies that are generated in the market

called “Information and technological Services” (INFOTEC) which has the task of establishing a communication mechanism and the transfer of scientific and technological knowledge existing in the country and overseas.

INFOTEC´s mission is to contribute to the improvement of productivity in the small and medium-sized enterprises, mainly facilitating access to information services consulting and training through integral services. It is focused on alternative analysis and strategic planning and the co-ordination of constant and exact information for any sector either industrial or services. It will support the industry in the identification and definition of technical problems and analysis of opportunities of business. It has the compromise to facilitate the access to the productivity world —competitiveness, modernisation and technological innovation.

Even this centre is not of recent creation. It has evolved constantly to offer services of a better quality and variety always endeavouring to maintain the vanguard when referring to technologies of information. So, this programme integrates Technology of information, Organisational Technology, and Technology of Production, tools that allow to offer viable solutions for an asequible positioning. For this, INFOTEC has the Technological National Net, the Centre of Advanced Technologies, Service of Managerial Information and the Organisational technology area.

In the regional field, there are different efforts to integrate the actors of the innovation systems in each place. CONACYT has formed the Regional Research System (SIRS) which allocates the federal entities of Mexico and share similarity and development degrees. The SIRS are instruments that contribute to the fortification of the decentralisation of the process and diffusion of science and technology and promote the regional development through the participation of the productive, academic and government sectors.

There are nine research systems in which the governments of the different states, CONACYT and the state ministries participate jointly.

Among the SIRS´s objectives we can highlight the following:

- To support the research and technological development that allow the knowledge and solution of economical problems that affect development in each region.

- To induce the participation of the productive sector in the fortification of activities of research and human resources formation to increase their level of competitiveness.

- To promote and foment the regional collaboration, as well as the inter-institutional, inter-sectorial, and multidisciplinary which allow an integral focus in the solution of regional problems through research.

- To promote development and consolidation of the scientific and technological capacities of the region.

- To contribute to the decentralisation process of science and technology.

- To form human resources in the different regions of the country where students that participate in the research projects and that aspire to elaborate their thesis in degree programmes (Masters and PhD degrees) find topics and applications of regional impact.

In 15 of the 32 states in Mexico, there are state councils of science and technology. These are the councils of the states of Baja California, Campeche, Coahuila, Durango, Guanajuato, Guerrero, Michoacan, Nayarit,

Puebla, Queretaro, Quintana Roo, San Luis Potosi, Sinaloa y Tamaulipas which constitute a permanent forum to discuss programmes and actions that foment the scientific research and technological development in the states of the republic, exchanging information about the systems of science and technology in different states, fomenting the co-operation between institutions and researchers in the states of the republic in common interest topics. Within the main initiatives to promote the commercialisation of generated technologies in universities and or public labs, with the objective of doing the transfers of technology more flexible it has been given more autonomy to public institutions that adopt the form of research public centres, so they have more independence when handling the resources that they themselves generate as well as the technologies that they develop. In the institutions of advanced public education in Mexico, there is a concern to allow researchers the access to economical yield in the generated innovations in these institutions as well as doing collaboration agreements with enterprises in more suitable conditions in which the institutions and enterprises share the rights of intellectual property and that these are used exclusively by the enterprises that ask for the IES support.

5. S&T Human Resources

The scientific and technologic community in Mexico is a small, but highly qualified group. We can see a lack of trained personnel to do tasks of science and technology, especially in research and technological development areas and in particular, in the productive sector. In order to face and correct this lack, the government has taken different actions. For example, the modification of studying programmes of the public universities in order to fulfil the working market requirements, information of new education centres, that is the case of technological universities whose main objectives are linked to the productive sector needs. Nevertheless, it is indispensable to form human resources with a higher educational level. In particular the CONACYT promotes the formation of students of excellence in the post grade level with special interest in mastering and doctoral levels. During the present administration a personnel formation programme in speciality level will be done, these studies will last six months or a year. In this programme we have the participation of enterprises of our country in order to have the students incorporate immediately after finishing their studies to the working field.

Recently, the evaluation criteria of post-grade programmes has been checked in order to apply the new UNESCO-classification to programmes directed to research (denominated type A) and the programmes directed to the productive sector or the working market (denominated type B). This new classification will allow either for the fortification of the programmes directed to research or the programmes directed to the productive sector. Since they have different criteria, a better specification is achieved in the characteristics of the teaching staff and learning teaching facilities as well as the studying programmes themselves. This will allow an increase in the number of programmes of technological type and the quality level to be increased. The present programme of science and technology establishes a goal for the increase of researchers in the productive sector and these researchers require a profile of post-grade programmes that are different form those profiles of researchers in areas of basic and directed science. For this reason, there is an interest increase the number of short-term post-grade programmes and to use the facilities or labs more directed to technological research.

It is clear that, to achieve this goal of the science and technological programme, the active participation of enterprises of the productive sector is needed. For this, the use of the denominated concurrent funds will be done and it will be worked in the branch of economical activity and according to the sectorial programme of CONACYT with the economy ministry that involves a great number of productive activities.

Besides, it is not only an objective of PECyT´s, but the development national plan that there must be a tendency to more equity of genre and in a shorter period of time. In regards to the special programme of science and technology, the line of action to warranty the equity of genre in all the system and to promote

actively that equity of genre is specified, and that equity is promoted in new generations of researchers and students.

There are support programmes to do studies at post-grade level overseas via federal government, supporting in the CONACYT mainly, institution that supports around 1,500 students of post-grade overseas and that represents more than the 15% of the total of 10. 000 scholars supported by the council.

The council has a programme denominated “Researchers repatriation” through the one it is fomented that Mexican researchers, who are currently living in foreign countries can obtain economical support to return to the country. The success of such programmes is rather limited, but will be achieved during the present administration. The special programme of science and technology establishes very ambitious goals in the growth of the number of researchers, due to this fact it will have to make improvements in the repatriation programme and will have to resort to new supports that are being developed.

6. International co-operation and globalisation

In Mexico, the co-operation and international link in science and technology has been transformed favourably. Gradually, the individual activities, the isolated ones and short term have been deleted to have new forms of institutional co-operation that finance impulse programmes of science and technology with organisms either from this country or foreign ones.

In the internationalisation process of the scientific and technological field the insertion of Mexico can be considered rather incipient. Nevertheless, the international collaboration in science and technology has been an efficient mechanism to fortify the programmes of post-grade scholarships, with direct benefits to Mexican students. The subscription of collaboration agreements with advanced education institutions more demanded by applicants of post-grade scholarships has brought, among other benefits, that the cost goes down in this kind of scholarships. For this reason, it is very important to fortify the subscription of agreements with educational institutions in the country and overseas in order to expand the destiny of scholars. On the other hand it is very important that Mexico promotes abroad its offer of education of excellence in order to achieve a balance between the flow of students of national post-grade who go out of the country and foreigners who come to the country. Besides, our country is a member of several multilateral organisations that promote the development of joined activities of science and technology in different aspects: research and development, human resource formation, etc. This participation has allowed researchers and students to access in the infrastructure and generated knowledge in other countries as well as to receive foreign personnel with higher qualifications in their specialisation areas.

7. Industry-related policies

During the last decade our country has achieved different agreements in the commercial field with a great amount of countries and commercial blocks around the world. This way, Mexico is the country with the most number of commercial agreements in all the world. Due to this fact, the enterprises in our country have seen that field where they compete has been modified. On the one hand these enterprises have the possibility to expand their market when having an easier way of introducing their products in other countries, on the other hand their participation in the national market is threaten when they have to compete in this country with enterprises from overseas offering products with similar characteristics and sometimes with a lower price.

This has forced the private sector to react to this situation, most of the cases by improving the quality of the product or to go out of the market when they can not satisfy the new expectations of the consumers, with this problems the productive sector has implanted a series of programmes that allow the technological

modernisation of enterprises set in the national territory, and that promote the exporting attitude of the Mexican industry, mainly the small and medium-sized enterprise. This is the case with the programmes administrated by the economy ministry and other entities like the Exterior Commerce Bank.

In regards to manufacturing, there are no programmes that support a specific sector. An attraction policy for enterprises to do certain productive processes in our country has been implemented, in most of the cases of assembling or manufacturing. These enterprises have the obligation of commercialising their products in the exterior rather than in the country, so the manufacturing industry of exporting can take place. There are certain fiscal exceptions, in particular in relation to exemptions with import tax.

Nowadays, there is a fiscal incentive for enterprises that spend on personnel training. This training can be done in different levels and it is not associated to any specific situation. This incentive consists in making the total amount spent in training deductible immediately only if it does not exceed the 1 % of the total income of the enterprise. There are some other incentives for enterprises that invest in instruments that have an impact in pollution reduction.