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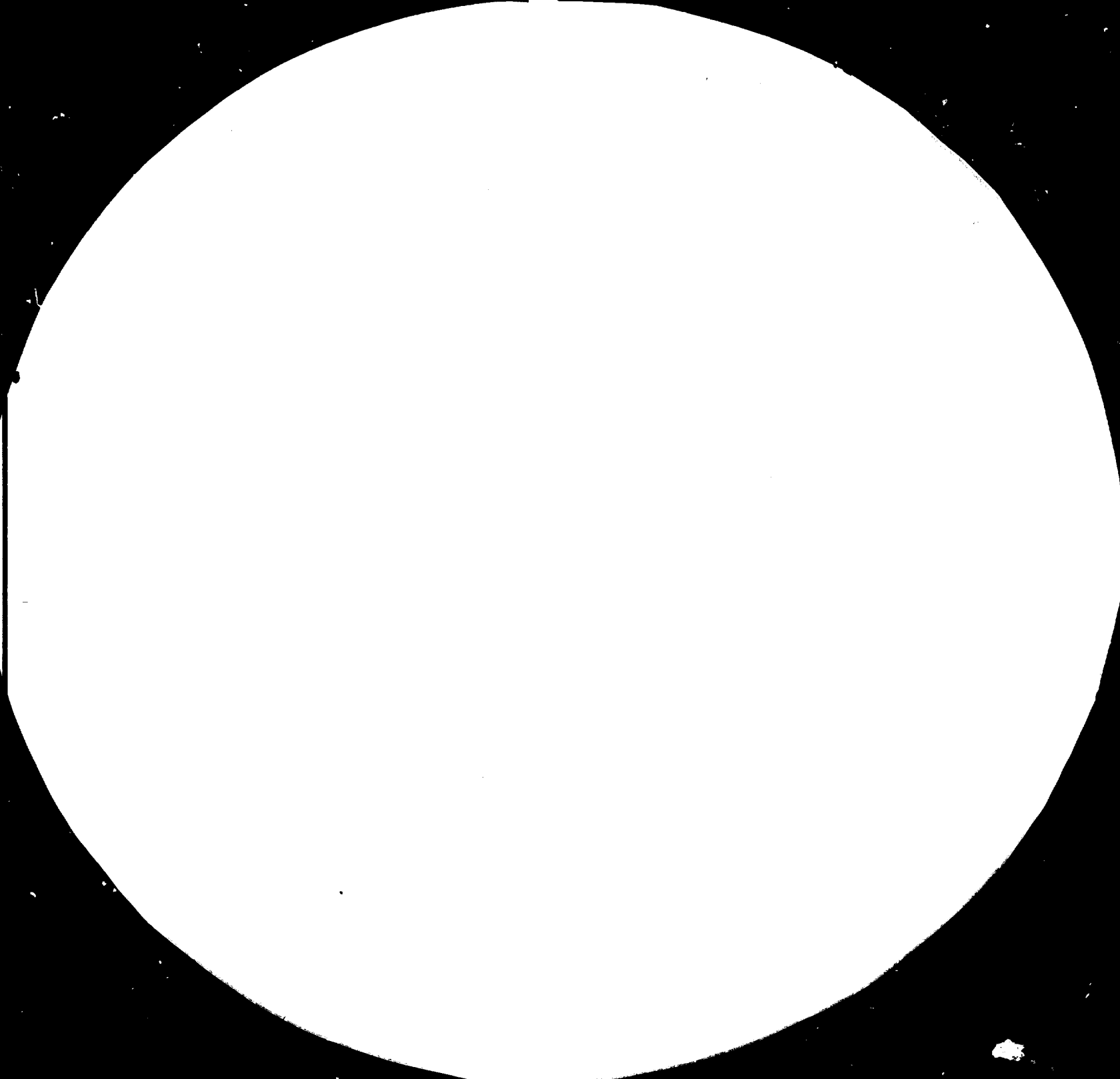

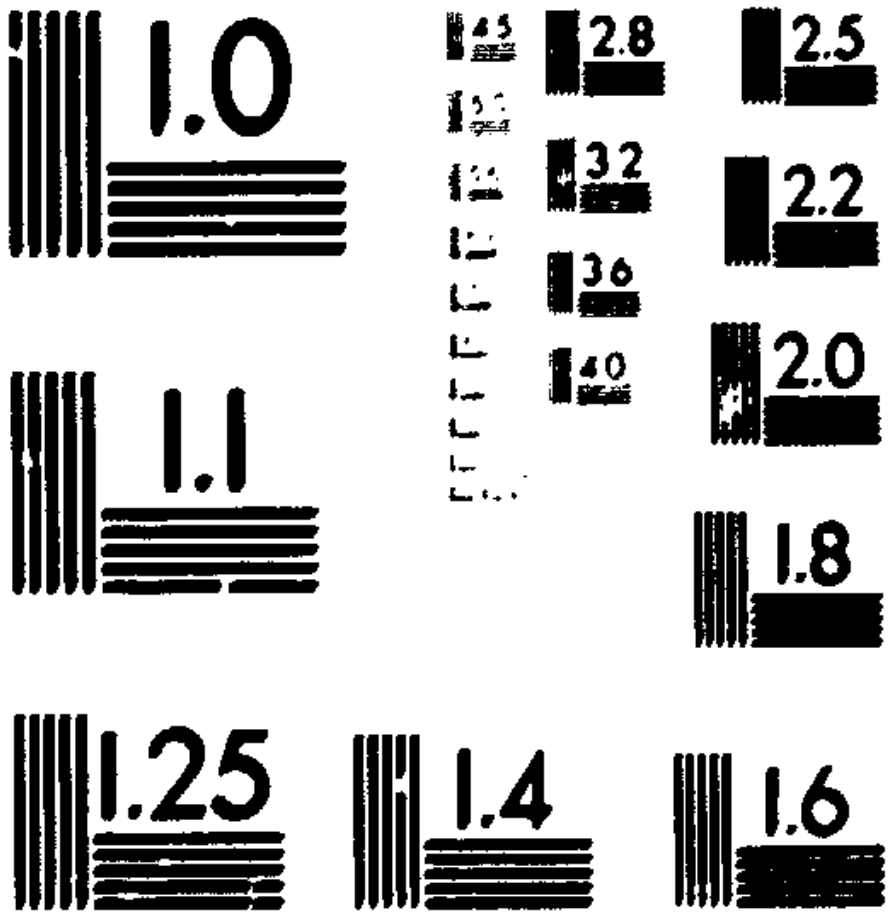

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TECHNOLOGY MONITORING IN THE INFORMATION TECHNOLOGY SECTOR IN ARGENTINA *

Prepared by

Sean Eamon Lalor **
UNIDO Consultant

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** Head, Policy and Planning Group, National Board for Science and Technology, Shelbourne House, Shelbourne Road, Dublin 4, Ireland.

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P R E F A C E

The Government of Argentina has published its five year Economic Plan and is developing sectoral policies to support it. The policy for one such sector - Informatics - has recently been published.

The Government sought advice from UNIDO on methods of monitoring technological trends in the context of the Informatics policy. The author of this report spent two weeks in Buenos Aires responding to this request and this document is the report of his findings and recommendations.

The author wishes to acknowledge the courtesy and support offered to him by Argentine officials notably: Dr. M. Sadosky, Secretario de Ciencia y Técnica; Dr. C. M. Correa, Subsecretario de Informática y Desarrollo; Ing. M. Greco, of CONICET; Dr. R. Soifer and Dr. D. Chudnovsky; and Dr. E. Mari and Ing. A. Dmitruk of INTI.

SUMMARY

The new policy for informatics is discussed in Chapter 1. It aims, among other things, to give preferential support to selected national companies manufacturing products in selected segments of the information technology market in such fields as computing equipment, communications equipment and industrial electronics equipment. It will be important to ensure that in due time after a sufficient learning period, the products of this new national sector are competitive in quality, price and functionality with other products in the market.

The existing Argentine industrial and research capacity in the information technologies is briefly described in Chapter 2.

Chapter 3 discusses technology monitoring approaches in the context of current Argentine needs and present capacities in this sector. A number of suggestions are made relating to certain elements of what could become in time a national system for monitoring technical change.

The central recommendation of the report concerns the specific short and medium term needs of the Subsecretario de Informática y Desarrollo in relation to policy oriented information and advice. An Information Technology Monitoring Group is proposed for this purpose and its function, scope, composition, methods of working and budgetary requirements specified.

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CHAPTER 1. BACKGROUND

1.1 INTRODUCTION

Whereas Argentina was, for a long time, classified as a "developed" economy in the Latin American context, its present economic condition shows certain of the characteristics of underdevelopment common to its neighbours in the continent.

Argentina's early economic expansion was based on agricultural exports but it also, since the early part of the century, involved industrial development to supply growing internal markets and some exports. The 1930's and 40's saw a strengthening of Argentina's industrial base with a result that the country entered the 1950's with industrial leadership in Latin America having 31% of the regional manufacturing product against 23% for Brazil. By 1978, however, the relative shares were: Brazil 39%, Mexico 23% and Argentina 15%. Further due to economic policies in recent years which favoured a strong (some would day seriously overvalued) currency and freedom of imports, whole sectors of Argentine manufacturing industry were destroyed as foreign imports swamped national suppliers.

When the present democratically elected civilian government took office in 1984, the country -despite its great natural resource based wealth and obvious potential- faced the following difficulties:

- a huge foreign debt
- an extremely high rate of inflation
- a depleted industrial sector and
- a severe lack of investment resources (most of the very great personal wealth of Argentina is invested outside of the country).

The government undertook to remedy this situation and adopted a macroeconomic policy and is preparing supporting sectoral policies and plans.

1.2 MACROECONOMIC PLAN

In January 1985 the government published its five-year Economic Plan under the title of "Lineamientos de Una Estrategia de Crecimiento 1985-1989".

The document aims to provide the guidelines of a strategy to overcome the economic emergency which affects the country and to recover the capacity for growth. Broad policy guidelines are set in relation to

- the maintenance of a high and stable exchange rate
- the role of the public sector
- tax reform (both to encourage investment and to promote equity)
- the reform of the public sector
- the reform of the financial system.

The document then sets sectoral guidelines relating to

- Agriculture and livestock
- Industry
- Energy

The regeneration of the capacity of Argentine manufacturing industry to expand its output is a major objective of the Plan:

. Considerable emphasis is placed on expanding the volume of exports and a number of measures are proposed.

. A policy of tariff protection and selective import substitution will be pursued.

. A program of remodeling existing industry is to be initiated.

. Positive measures will be introduced to promote industrial development and regional development where enterprises can be encouraged to export and where additional value-added can be generate in named sectors including electronics.

. The purchasing power of the State will be exploited in pursuit of national industrial development.
. Applied research is to be fostered through contracts between the public and private sectors.
. Special measures will be introduced to assist small and medium sized enterprises.

The Plan foresees an annual growth rate of 11.9% in the export of industrial products in the period 1985-89.

1.3 THE INFORMATION TECHNOLOGY SECTORAL POLICY

The industrial sector deriving from the electronics based information technologies viz
- information (data and word) processing equipment
- electronic instruments and control equipment
- electronics based consumer products
- electronic components
- software,

is the focus of this report.

The Government of Argentina recognising:
. The strategic importance of this sector within its economy;
. The great potential for growth of the sector in Argentina and
. The considerable benefits to the country of the timely and appropriate application of the new technology to industry as a whole, to services, to commerce and to social organization in general,

established a Commission in mid-1984 to prepare suitable policies for the sector.

This Commission (Comisión Nacional de Informática) met under the presidency of the Secretary for Science and Technology and had all relevant Ministries including Economy (and Industry) represented on it. Some 200 people were involved in the work of the Commission for a period of six months. The report of the Commission -Informe Comisión Nacional de Informática- was adopted by the Government and published in March 1985.

The Commission concluded that despite the relatively under-developed nature of the sector in Argentina, and despite the substantial barriers to new firms entering the market due to:

- rapid technological change
- high investment (including research and development) costs
- the dominant position of established multinational companies in the market,

nevertheless, existing Argentine competence was such that certain discrete opportunities could be exploited by national firms. The Commission therefore proposed a policy for industrial promotion.

This policy is to be selective at two levels.

Firstly, a number of discrete product segments were identified for specific Government intervention (see Table I).

Secondly, following the evaluation of calls for tender, a number of specific firms would be selected to benefit from Government incentives. A comprehensive package of incentives would be made available to selected firms. These incentives will include:

- financial incentives
- tax incentives
- tariff concessions
- public purchasing preference

TABLE I. SEGMENTS SELECTED FOR PROMOTION

Data Processing	Telecommunications	Industrial Electronics
Systems of class 0 and 1 based on micro-processors; including entertainment	Public exchanges and peripherals	Process control systems of less than 1000 points
Systems of class 2 (minis and super-micros)	Private exchanges	Programmable controllers
Peripherals for above classes (except rigid removable discs)	PCM and TDM channels (digital multiplexors for voice and data)	Numerical control systems
Local networks based on micros	Modems	Small Robots
Automation of Banking, Commerce and offices		Instruments based on micros
		Agricultural Electronics
		Nuclear Electronics
Medium scale and semi-medium scale integrated circuits.		

Firms eligible for the Government assistance must be majority owned and effectively controlled by Argentina. At least, 51% of the capital must be Argentinian, and the technical, administrative, financial and commercial aspects of the firm must be under Argentine control.

Firms which benefit from Government promotion must agree to a number of pre-determined conditions in relation to:

- progressive levels of national integration
- quality
- price
- volumes of exports
- development/assimilation of technology
- etc.

Firms who do not qualify for Government aid may also compete in the market, albeit at a disadvantage.

The intention is that Government assisted firms will in due course subject their products to international competition on export markets.

At the end of January 1985, the Secretariat of Industry of the Ministry of Economy issued a public call for tenders for systems and equipment in the data processing sector roughly as specified in column one of Table I, above. The product characteristics are described and the conditions (see list above) laid out in detail including minimum volumes of annual production. The tender action closes on 2 May, and the offers will then be subject to a rigorous evaluation which will result in the selection of companies which qualify for Government assistance.

The Report of the Commission also addresses other aspects of a total national policy towards the information technologies under the headings:

- the development of software
- research and development
- training of specialists and technicians
- policy for informatics in public sector administration
- informatics in primary and secondary schools
- trans border data flows, and
- institutional mechanisms for managing the new policy.

1.4 COMMENTS ON INFORMATICS INDUSTRIAL DEVELOPMENT POLICY

In response to a request from the Secretary for Science and Technology, the following comments on the new informatics policy are offered:

i) The policy is well thought out and presented and would appear to be at the same time both imaginative and realistic.

ii) The policy is likely to lead to the establishment of a number of national companies successfully manufacturing informatics products in Argentina.

iii) The fact that competition with the products of firms other than those selected is to be permitted is welcomed (this contrasts with the corresponding Brazilian policy with which the present one shows many parallels.)

iv) The requirement to export is welcomed.

v) The real test of the success of the policy will be in the market place, firstly the home market and then crucially the export market. The ultimate aim of the policy should be to promote competitive products. Special incentives - including

tariff protection - are valid measures to create a new industry and tc protect an infant industry.

If the policy is genuinely directed towards the promotion of competitive products (and not just a subsidized import substitution policy) then these special supports should not continue indefinitely. In particular, the maintenance of high levels of tariff protection will not encourage the development of products which would be genuinely competitive on home markets and capable of penetrating foreign markets. A policy for the gradual phased dismantling of tariff protection as firms reach maturity might be contemplated.

vi) The tender documents have been well-received by industry as an indication of the Government's serious intent to implement the policy. The documents are lengthy, detailed and strict in the conditions laid down. Whereas the objective of rigorous evaluation and the assurance of maximum compliance to conditions is fully supported, nevertheless, the decision makers should reserve the right to be flexible in interpretation if necessary, in order to achieve the maximum beneficial effect of the tender action.

CHAPTER 2. EXISTING SITUATION IN INFORMATION TECHNOLOGY

2.1 INDUSTRY*

The total market for information technology (I.T.) products in Argentina is of the order of US$ 1 billion (US$ 1.2 billion if one includes the military market). The civilian market is divided roughly as follows:

Consumer Electronics	US$ 400
Communications Equipment	US$ 300
Other Professional (computers, industrial electronics and instruments)	US$ 300

Table 2. I.T. Products Market in Argentina (1981)

About 70% of this market is supplied by firms manufacturing in Argentina but significantly more than 50% of this is supplied by multinational enterprises. The value of exports of I.T. products manufactured by national firms is a small number of tens of millions of dollars.

A brief description of the activities in the various sub-sectors will be given below.

i) Communications Equipment

The sector has about forty enterprises of which two are leading firms, four are large firms, seven medium sized and the rest small.

The two leading firms supply more than three quarters of the US$ 300 million market. Total employment in the sector was 7,400 (1981) of which 320 were professionals. Total R+D in 1980 was

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* The information presented in this section is very limited. For a much more comprehensive analysis see References 1 and 2.

about 10 man-years/year. A more detailed breakdown of these statistics is provided in Appendix 1.

ii) Computers

No national production at present. IBM manufactures printers and magnetic tapes.

iii) Industrial Control

A number of firms including a number of national firms producing products of good quality.

iv) Instruments

A number of firms including a number of national firms producing products of good quality.

v) Components

Certain passive components produced locally but no active components.

vi) Materials

None

vii) Software

A range of firms providing standard administrative products and services.

viii) Consumer Electronics

As a result of a regionalization policy, the consumer electronics sector is located primarily in Tierra del Fuego. Incentives include more liberal conditions on national integration and more ready access to imports of components. Under those

conditions, a range of companies - largely joint-venture between national capital and European, Japanese and U.S. firms - manufacture about US$ 400 million a year (1981) worth of T.V.'s, radios, audio equipment, video equipment, calculators, etc.

Comment

The foregoing brief survey of the Argentine electronics sector shows an industry which is largely devoted to assembly, engages in relatively little research and development, has a relatively small wholly owned national sector and (apart from a few exceptions) exports relatively little.

2.2 RESEARCH AND DEVELOPMENT

This section briefly lists the R+D institutions with activities relevant to the I.T. sector.

i) LANTEL

The National Telecommunications Laboratory reports to the Secretary of Communications (Ministry of Public Works). It has a staff of 50:- 30 engineers, 10 technicians and 10 support staff. LANTEL's programme is divided into two parts - development and technical.

The development activities are:

- applied research and development
- technology monitoring and support
- industrial assistance

A number of LANTEL's technical developments have been commercialized notably a VHF Multi-Channel Automatic Rural Telephone System.

In some instances, it will initiate a development at its own initiative. In others, it responds to industrial requests.

The technical activities include:

- standardization and
- measurements

National standards are elaborated and corresponding tests and measurements performed on different types of equipment sold in the country.

LANTEL keeps up-to-date technically via the technical literature, membership of its staff in professional bodies and the membership of the laboratory of the Pan-American Association of Centres of Research in Telecommunications-AHCIET.

ii) I.N.T.I.

The National Institute for Industrial Technology reports to the Secretary of Industry (Ministry of Economy). Its headquarters is in Buenos Aires. Most of its technical activities are located at the Parque Tecnológico Miguelete outside the city; but it also has a presence in other cities such as Córdoba, Mendoza, Rafaela, Villa Regina, Mar del Plata, etc. It employs about 1500 people, of whom roughly one third are graduates, one third technicians and one third support staff. Its operating budget is of the order of US$ 25 million, which has in the past come from a levy on industry, is currently funded through the exchequer and is expected to revert to a levy on industry in the near future.

The Institute is organized in two ways viz: into Departments based on disciplines e.g. physics, mechanics, chemistry, etc. and into centres based on industrial sectors or other specialized interest groups.

There are 25 centres in all, dealing with such sectors as: paper, milk, machine tools, etc. Industry participates significantly in the management of the centres which have a certain degree of autonomy from the INTI. The Centres have been particularly successful where the firms in the sector had a more or less homogeneous requirement - normally a process requirement. Where there are disparate requirements - normally involving products - they are less successful.

A new form of organization is currently being introduced into INTI; whereby all its activities - whether in Departments or Centres - are being aggregated into seven programmes:

i) Metrology, Applied Physics and Quality Control
ii) Construction and Housing
iii) Chemical Processes
iv) Metal Mechanics
v) Food
vi) Natural Products (other than food)
vii) Electronics, Informatics and Telecommunications

The Electronics Programme which is currently being put together consists of the following elements:

a) Computation (about 25 people)
b) Applied Microelectronics (microprocessor applications)
   Two projects presently underway deal with the control of elevators and the development of a PABX (about 15 people).
c) CIMATEL - cooperation between INTI and LANTEL.
d) The Electronics Department of INTI dealing with:
   - Metrology
   - Technical services to industry (test, quality control, radio interference)
e) Electronics instrumentation groups of the various centres.

It is proposed to develop two additional centres of expertise:

f) a centre dealing with the technology of components having the following elements:
   - design (CAD of active LSI circuits)
   - quality control
   - testing (active and passive)

g) a centre dealing with computing and supporting the software industry in such areas as:
   - software evaluation
   - operating systems / compilers

The staff of the Institute keep themselves technically up-to-date through:

- the literature
- visits to other research centres
- visitors from other research centres
- involvement in international bodies (e.g. association of metrology institutes in Latin America)
- bilateral cooperation agreements (e.g. with the P.T.B. of Germany)

The greatest problem the Institute faces in updating relates to the acquisition of advanced state-of-the-art technical information of direct relevance to industry.

iii) CITEFA

CITEFA is an advanced research centre associated with the military. It is active in such areas as:

- microwaves
- lasers
- antennas
- infra-red technology

It has a specialized group (about 40 people) working on electronic components specializing in hybrid circuits on thick films. It runs a pilot fabrication plant. Some of its circuits have been incorporated into military equipment such as walkie-talkies, transceivers, etc.

In recent times, it has cooperated with CONICET in relation to the civil side of its activities.

iv) CONICET

The National Council for Science and Technology is a major institute involved in the promotion primarily of basic research. It reports to the Secretary of Science and Technology (Ministry of Education). It involves about 7000 people broken down roughly as follows:

2000 researchers
2500 technicians
2000 fellowships
300 administrative

It is organized into more than 100 discipline oriented institutes. The Council is advised by eleven Committees dealing with various scientific disciplines such as:

Physics and Computing
Biology
Health
Engineering and Technology
Social Sciences
Agriculture
etc.

The Council runs a science and technology information service to interested users. The following services are available:

i) A comprehensive catalogue of library holdings of books and journals on science and technology. An effective inter-library loan system operates. This service is widely used.

ii) Access to on-line international data bases (two services in U.S. one in France). This service is very unfrequently used (less than 500 searches since 1981). The high costs involved are blamed.

iii) A photocopying service

iv) A translation service (into Spanish from languages other than English, Italian, Portuguese).

CONICET is currently under review with the intention of: orienting it more closely with current needs; rationalizing the large number of Institutes and restructuring the management. It is intended to strengthen the relationship between the Council and the Universities.

It is also intended to create a new Unit within the organization dealing with:

- monitoring the market (demand) for S+T
- cataloguing existing competence
- offering existing competence to the market and
- creating and spinning off technology enterprises.

v) <u>The Universities</u>

Electronics related research activities are carried out in:

- the University of Buenos Aires
- the National Universities at: Córdoba, La Plata, del Litoral, Rosario, San Luis, San Juan, del Sur, Tucumán.
- the National Technological University at: Córdoba and Tucumán
- the University of Belgrano.

vi) Other Institutes

For completeness sake two other major Institutes with electronics activities are mentioned:

- The National Institute for Agricultural Technology (INTA)
- The Nuclear Energy Commission

Comment

It is clear from the proceeding that there exists in Argentina pockets of excellence in research and development in the information technologies. It is however also clear that this expertise is dispersed and inadequately resourced with manpower and equipment. This distributed resource does not often add up to a critical mass of expertise and facilities capable of making a major advance in the state-of-the-art. An attempt to coordinate this expertise through a National Programme for Electronics under the Secretary for Science and Technology would not appear, so far, to have resolved this difficulty.

2.3 GOVERNMENT STRUCTURES FOR THE INFORMATION TECHNOLOGIES

The information technologies are of relevance right across the structures of Government with many Ministries, Secretariats and Agencies having responsibilities. For the present purposes, three Secretariats are of particular importance: the Secretariat of Industry (together with INTI) and the Secretariat of Communications (together with ENTel, the operating company, and LANTEL). See Appendix 2 for Government organigram.

Within the Secretariat of Science and Technology, the Subsecretariat of Informatics and Development has a special importance. Its responsibilities include:

- to undertake analysis leading to the elaboration and implementation of national policies for informatics;
- the formulation of informatics policies and standards for public administration and dependant agencies;
- to promote the design of systems and the processing of information connected with Science and Technology.

The National Commission on Informatics made recommendations for new structures in this field.

The principal recommendation concerns the creation of a National Committee for Informatics, Telecommunications and Electronics (CONITE). The Committee is to have four organs:

A) A high level Board overseeing planning and the supervision of policies.
B) A committee of Secretaries of the operational areas.
C) A committee of technical advisors reporting to B)
D) A Secretariat reporting to the Subsecretary for Informatics and Development.

The Board A oversees the policy. The Committee B and subsidiary organs will be charged with advisory and coordinating functions across the whole of the national executive. Its responsibilities will cover:

- preparation of plans, guidelines, standards and regulations required to execute its policies;
- funding research and development;
- planning the purchasing of public agencies;
- incentives and industrial promotion measures;

- authorization of foreign investment and transfer of technology contracts;
- international agreements;
- setting of technical norms in relation to patents and inventions;
- fixing and revision of tariffs;
- authorization of the acquisition or leasing of certain informatics goods and services.

Comment

Policies for the information technologies are 'horizontal' in their impact and need strong horizontal coordination. This coordination is in practice extremely difficult to achieve since the various Ministries and agencies involved each have their clear and separate interests which are by no means always identical and which are often in conflict. Thus, conflict can arise between, for example, the telephone operating company which would see its remit as ""the provision of the best telephone service at minimum cost" and the Industry Ministry which might be anxious to promote a national telecommunications manufacturing sector. Many other examples can be given. Mechanisms must be provided to resolve these conflicts; to determine the overall national interest and to ensure overall compliance with agreed government policy.

The proposal of the National Informatics Commission for the establishment of CONITE is certainly a comprehensive response to this requirement. The principles underlying it are strongly supported. Since it is so comprehensive there is a danger that total agreement to it may by difficult to obtain. If, despite best efforts, agreement is difficult to achieve or slow to mature a pragmatic approach aimed at proceeding in a first phase with mechanisms reflecting the greatest measure of agreement is recommended. Subsequent phases would add additional functions to the mechanism.

CHAPTER 3. TECHNOLOGY MONITORING

3.1 INTRODUCTION

Summing up the present position:

- Government policy is directed towards the creation of a national industrial base in certain well defined segments of the information technology sector. The State supported firms will be expected in time to become competitive, to satisfactorily substitute imports and in due course to gain exports in niche areas.
- The existing industrial base in some of these areas is either non-existent or weak. Argentine industry in the sector is mostly dedicated to assembly with relatively little research and development and low volumes of exports.
- The existing scientific and technological infrastructure underpining this sector contains packets of excellence but is dissipated over a large number of institutions. Most groups are underesourced in equipment and staff and the groups, separately, do not constitute critical masses of expertise capable of advancing in a significant way the state-of-the-art in their discipline.

Access to technology will be a key determining factor in Argentina industrialization plans in this sector. In fact, the rate of technological change in the Information Technology (I.T.) sector is so great that at the cutting edge the elapsed time between the introduction of a new product to the market place and its obsolescence can sometimes be measured in months rather than years and the passage of a decade brings revolutionary changes.

Information about technology and market development will therefore be crucial. As the economies of the developed countries move into the so called 'post industrial' phase, the appreciation of the value of information rises. More than two thirds of the U.S. G.D.P. is currently generated in the 'information sector'. Information is increasingly seen to have value and is perhaps the most valuable commodity of all. Information is now big business and it is not cheap.

This places less developed economies at a double disadvantage. Firstly, they do not have the state-of-the-art industry and secondly, information as to how to develop it becomes increasingly beyond their means.

This Chapter takes a pragmatic view of the situation currently facing Argentina. It first sketches the elements of a national approach to technology information acquisition and then proposes a concrete mechanism - an I.T. monitoring group - or starting the process of monitoring developments of direct interest to policy formulation in the information technology field.

3.2 ELEMENTS OF A NATIONAL TECHNOLOGY MONITORING SYSTEM

No single approach to the acquisition of technical information is likely to be sufficient. In practice, a national system will have many initiatives proceeding in parallel of both a formal and informal nature. In this section a number of such possible approaches are discussed. The discussion is in no sense exhaustive. It is intended simply to illustrate some elements of a comprehensive national system for technology monitoring. Substantial additional

work would have to be done before such a comprehensive system would be put in place.

i) The Open Literature

All technology monitoring must start with the open literature in the form of books, journals, data banks, etc.

It would appear that Argentina has adequate stocks of technical literature. It has been noted above that CONICET keeps an up-to-date record of library holdings of Science and Technology literature throughout the country, that the service is widely used and that an efficient inter library loan system operates.

Two problems are however apparent. In the first instance, modern methods of information retrieval using on-line computer held data bases (which may be interrogated using key words designed to identify relevant literature) are very infrequently used in Argentina. The efficiency of interfacing with existing literature must therefore be reduced. There are perhaps two reasons for the situation: cost and lack of familiarity. Solutions normally applied in such situation involve training of operators and users and promotion of use, including the subsidising of the service in an initial period.

The second problem relates to the apparent absence of a 'value-added' information service in Argentina. In other countries there exists a service which can search for information and 'package' it to conform to a given users' requirement.

The case of Mexico might be instructive in this regard. Within the Mexican CONACYT, about a decade ago there existed an information service - probably similar in nature to that presently existing in the Argentine CONICET. The Mexican authorities were anxious that this service would be widely used by Government and industry and so they spun off the service from CONACYT and established a new organization called INFOTEC. It is important to emphasize that the services of INFOTEC are value added services where information is packaged to suit the users' profile. Further the information is no longer limited to classical science and technology information but also covers products, markets and other commercial information. INFOTEC will also add further value by carrying out market surveys and market analysis on request. INFOTEC is largely supported by the fees it earns from users.

ii) National Expertise

Information, no matter how comprehensive, well organized and easily accessible, is of no value unless local expertise exists, capable of understanding, analyzing and using it. The critical importance of having local technical competence underpinning technology based industrial development cannot be overstated.

It is beyond the scope of this paper to comment on the need for and plans for the build up of Argentine technical expertise in the I.T. field and the adequate coordination and integration of this expertise to ensure a critical mass of effort. What is important to say, however, is that the expertise that does exist should be used as the first port of call in any technology monitoring system. A local expert on, for example, Private Automatic Branch Exchanges (PABX's) will have not only his own knowledge of the subject but also a knowledge of the literature and a knowledge of

other people working in the field both nationally and internationally.

It has become axiomatic in the information business that the most effective transfer of information occurs on a person to person basis. Frequently, informal networks of information are more effective in practice than the classical formal methods.

The recommendation is therefore that for specific technology / product / market sectors needing to be monitored, a national expert is identified in the first instance and commissioned to put together all relevant information available to him from national sources and from his international contacts. Only when the possibilities of this approach are exhausted should recourse be taken to other methods of information acquisition.

In the longer term, it would be useful to develop and keep up to date a national register of expertise that could be called upon for such purposes. Another idea involves the routine commissioning on a regular basis of state-of-the-art reports from national experts across a range of relevant technology segment fields.

iii) Informal Networks Abroad

Argentina has many distinguished scientists and engineers working abroad in universities and in industry, in Latin America and in the USA. Such people could be a valuable resource for the country. An effort should be made to construct a register of these individuals and their expertise. Many of them may be willing to be consulted informally for specific information and judgements. On the other hand, the possibility could be explored of commissioning from them from time to time technology / product /

market state-of-the-art reports as seen from the perspective of their foreign location. These individuals could also be consulted on sources of information and technology in their local environment.

iv) Formal Networks Abroad

Many countries have the practice of appointing Scientific Attaches in certain of their Embassies abroad. These officers are charged with responsibility for managing formal bilateral scientific cooperation between the two countries. They can also serve an information function. Ideally, they would be briefed on the scientific and technological needs of their own countries and can seek to identify information and information on sources of information and sources of technology of relevance to their home countries.

Such officers need not operate from Embassies. Other official offices dealing with industrial or trade promotion may be just as good or better. Ireland, for example, has an infrastructure of offices around the world manned by the Irish Industrial Development Authority (IDA) and the Irish Export Board (CTT). These offices can be, and are, used for intelligence gathering on technology as well as on industry and trade.

It is recommended that Argentina considers establishing such a formal network of information gathering abroad. The officers manning these offices should ideally be experts in industrial technology. Expertise in intellectual property and technology bargaining would also be valuable.

In the shorter term, it is recommended that as a pilot experiment such an officer be appointed and located in Silicon Valley in California, USA, and specialized in the field of information technology. The Consulate of Argentina in San Francisco could be a suitable location for this expert.

v) Industry

Industry itself can be a valuable source of information. It must be stressed, however, that information of a commercially relevant kind is a valuable commodity, is frequently of a proprietary nature and is seldom made available without substantial charges.

In a start-up situation, Argentine industry may very well wish to purchase technological knowledge through entering into a licensing arrangement or other know-how agreement with an owner of technology. Commercial suppliers of this kind of technology may be identified directly through industry contacts or indirectly through technology transfer intermediaries (specialized consultants).

Wholly owned subsidiaries of multinational companies manufacturing in Argentina are unlikely to transfer significant technology to national enterprises. One possibility here, however, is to use the requirement of national integration to insist that MNE's assist in the technological development of their (national) sub-suppliers through the provision of know-how and training.

Joint ventures between Argentine interests and foreign interests can be a useful way of acquiring technology provided such technology transfer is written into the joint venture agreement and provided the Argentine partner has already enough technological competence to absorb the technology.

vi) Visits to Centres of Excellence

Visits to (foreign) centres of excellence can be a useful method of acquiring up-to-date information. Academic institutes and public research centres will be more open to visits but are likely to be some distance from industrial state-of-the-art. Laboratories associated with large industries (e.g. Bell Laboratories, USA, Bell Northern Research, Canada, etc.) will be at, or in advance of, the industrial state-of-the-art, but will be less open to sharing valuable information.

Public laboratories in Mexico which are worth a visit include:

- Institute for Electrical Research (IIE), Cuernavaca (microprocessor applications)
- Institute of Petroleum Research (IMP), Mexico, D.F. (electronic instrumentation for the petroleum sector)
- The Research and Development Centre of TELMEX, Mexico, D.F. (research on telecommunications equipment)
- INFOTEC (see above)

Brazil has a major Telecommunications Research Centre CPyD at Campinas.

vii) Regional Cooperation

Possibilities for regional cooperation on a bi- or multi-lateral basis are worth exploring. Such cooperation agreements can work at a number of levels:

- information exchange
- exchange of personnel
- joint projects

Experience shows that general science and technology cooperation agreements seldom live up to their expectation. Specific agreements between institutions with similar missions can be more valuable. Two good examples in Argentina are AMCIET (Pan-american cooperation on Telecommunications research) and the association for Pan-american cooperation on Metrology. In both organizations Argentine institutions play a major role through LANTEL and INTI, respectively.

It is recommended that the scope for cooperation on a discipline oriented basis be explored with Brazil and with Mexico. These cooperation agreements should ideally involve exchange of personnel and joint projects.

viii) Consultants

A costly but at times invaluable source of information and advice are specialized consultants. The best consultants have a wide range of technological, industrial and economic analytical skills and are fully informed of the sectors they specialize including such aspects as:

- technology trends
- industrial structure
- details of firms
- details of products
- details of markets
- sources of technology and terms
- etc.

A variety of services are offered:

- regular technology / product / market information reports constantly up-dated.

- an enquiry service responding to questions quickly where the information exists already in the consultants files;
- participation in in-depth multi-client studies of particular sectors (in such areas the costs involved are spread over a number of recipients of the same study);
- special studies specifically performed to suit an individual clients' requirement.

Despite the cost involved, the use of consultants may very well be the most cost-effective way of arriving quickly at the necessary information for policy advice. Consultants, however, require quite careful management in order to optimize the benefit achieved. Firstly, care must be taken on selection. It is advisable to consult other users of the service. It is also advisable to test the consultants with carefully prepared questions in direct interviews. It is particularly important to develop carefully a comprehensive project specification and to ensure that this is agreed by the consultant. It is further important to monitor the progress of the consultant's work through the face to face discussion of work in progress.

3.3 AN INFORMATION TECHNOLOGY MONITORING GROUP

It could take some considerable time before a comprehensive national system for monitoring technology - containing the elements described in the previous section and others - was put in place. In the meantime, the Subsecretario de Informática y Desarrollo has an urgent need to be advised on technological and other trends relating to the information technologies so that he can effectively execute his immediate responsibilities. The main recommendation of this report

is the creation of a group of experts - an Information Technology Monitoring Group (ITMG)- to assist him in this respect. The function, scope, composition and methods of working of such a group is described below.

i) Function

To advise the Subsecretario de Informática y Desarrollo on technology, industry and market trends in the information technologies. This advice is to be issue oriented and relevant to the practical policy concerns of the Sub-secretario.

ii) Scope

Information would be gathered and analyzed in relation to some or all (depending on the particular issue being studied) of the following:

. Generic Technology
  - existing state of the art
  - future trends
. Products
  - product cycles and obsolescence
  - difussion patterns
. Manufacturing
  - design and engineering
  - processes and production equipment
  - materials
  - components and sub-assemblies including sources and prices
. Industry
  - structure
  - firms
  - competition

. Markets
  - structure
  - trends
  - distribution and export channel
. Industrial Technology
  - standards and quality requirements
  - patents
  - licensing and know-how opportunities and conditions
  - joint ventures

The intention would be that the group should be capable of answering real and practical questions of actual policy concern, such as:

a) Can an Argentine firm succeed in manufacturing a digital private automatic branch exchange (PABX) which would adequately meet local requirements and be sufficiently competitive to enter export markets successfully in five years?

b) What trends in microelectronics technology are of relevance in enhancing the competitiveness of the Argentine machine tool industry and how in practical terms is this technology to be acquired and transferred into use?

c) In what niches of the software sector can Argentina develop and exploit a competitive advantage and achieve exports to the Spanish speaking world? What infrastructural and other supports would be required to achieve this?

It should be emphasized that the group's role would be limited to advising the Subsecretario on issues such as this. It must not be given an operational role. For example, in relation to the machine tool sector its role would cease having completed its study.

Any implementation requirements could be met by INTI, for example.

iii) Composition

It is recommended that the group consist of a small permanent core of some three or four senior experts. Their expertise should include advanced knowledge and experience in:

- technology (high level I.T. background)
- industry (actual senior industrial experience)
- industrial economics and analysis

On a study-by-study basis, the group would be supplemented by an expert with specific expertise in the sector being analized (e.g. a software expert for the software study). That experts involvement would end with the conclusion of the study. The group could be supplemented by one or two research assistants who would be concerned with data gathering and routine analysis. Adequate secretarial support should be available.

iv) Methods of Working

No hard and fast methodology will be laid down a priori. The group would be expected to refine its approach as it gains experience through the actual conducting of studies. The following suggestions are however made:

a) After a brief preliminary survey the group would select a small number of issues (like those suggested above) for investigation. Following the agreement of the Subsecretario, work would start - maybe initially on only one such study as the group is establishing its approach.

b) A national expert in the particular product or process being investigated (e.g. PABX's) would be identified in e.g. LANTEL, industry or the Universities and seconded to the group.

c) Using initially the local contacts and knowledge of this expert, the group would gather all relevant information which can be obtained within the country.

d) The group would assess this locally available information to see if it is sufficient for their purposes. If it is, they would undertake the analysis and produce their report.

e) If it is not sufficient, the group would exploit available sources of information abroad such as:
   - Argentinians working in relevant fields in Universities and Industry abroad.
   - Intelligence gathering exercises undertaken from the offices of official Argentine representatives abroad.
   - Bilateral cooperation agreement.
   - Visits to foreign centres of research and analysis.
   - etc.

f) If information gathered in this way is sufficient the study can be completed.

g) If this information is still not sufficient a specialized (possibly foreign) consultant could be hired to advise the group. Such consultants can make an extremely valuable contribution or be a complete waste of money depending on how they are managed. They should firstly be carefully selected following interviews in which their answers to detailed relevant questions (prepared in advance) are assessed.

They should then be monitored by the group at regular intervals to ensure compliance with the agreed project specification. Considerable care should be taken in preparing this specification.

v) Budget

The group must have a budget to cover:

- the salaries of its members
- acquisition of reports and materials
- elements of the work contracted out either nationally or internationally
- travel nationally and internationally to centres of expertise.

Final Comment

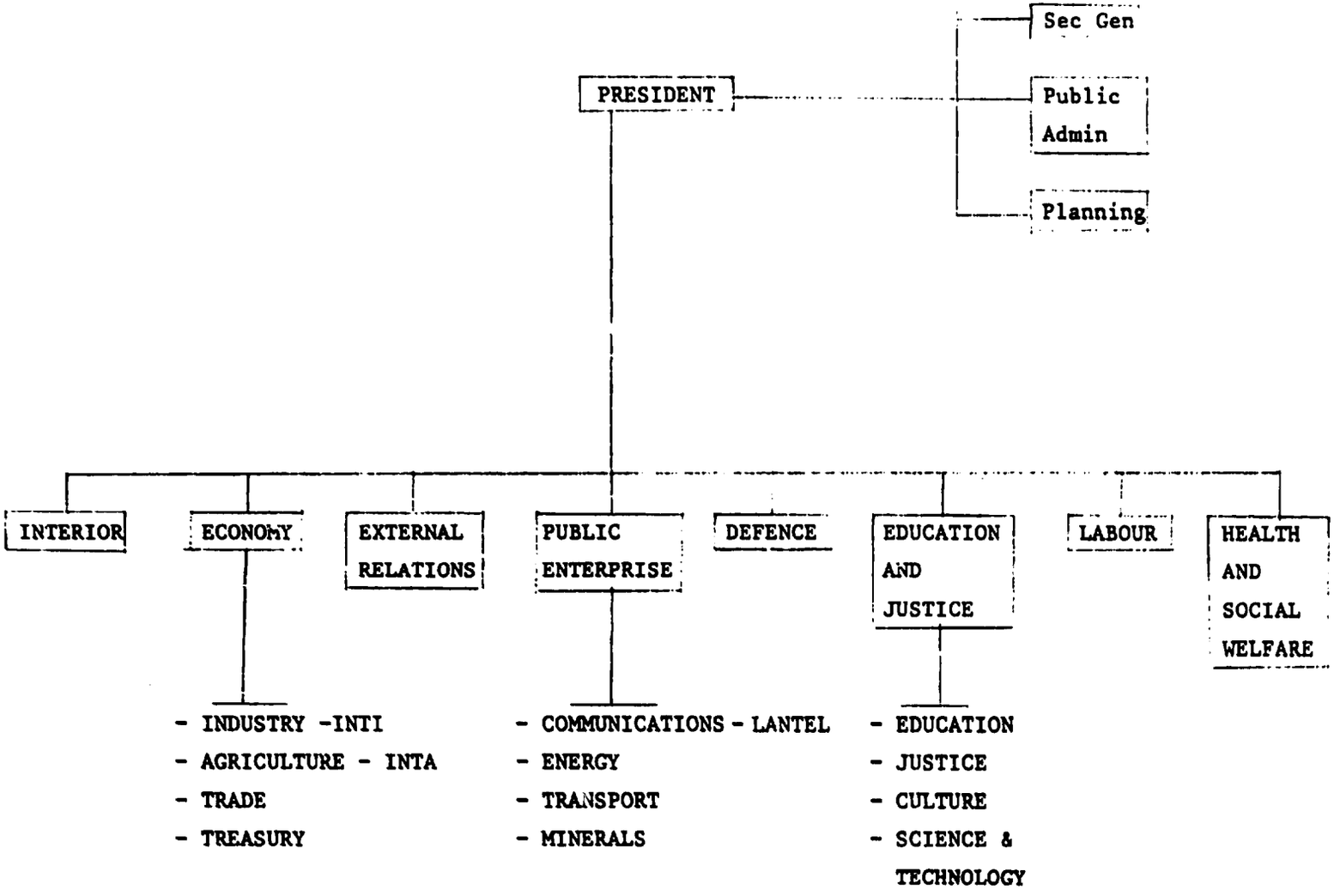
In addition to its study-specific activities, the group will have a need to engage in a certain amount of general surveying of background information at home and abroad including some foreign travel. This general non-project-specific activity should be only a small fraction of its total activities. Among these general activities, however, study missions to Brazil and Mexico to assess expertise and to explore the scope for cooperation are obvious candidates.

Finally, it is recommended that the group be established and start work in the immediate future. It should develop its procedures through the actual execution of two or three concrete studies and its performance should be reviewed in, say, one year with a view to assessing its performance and instituting any necessary change.

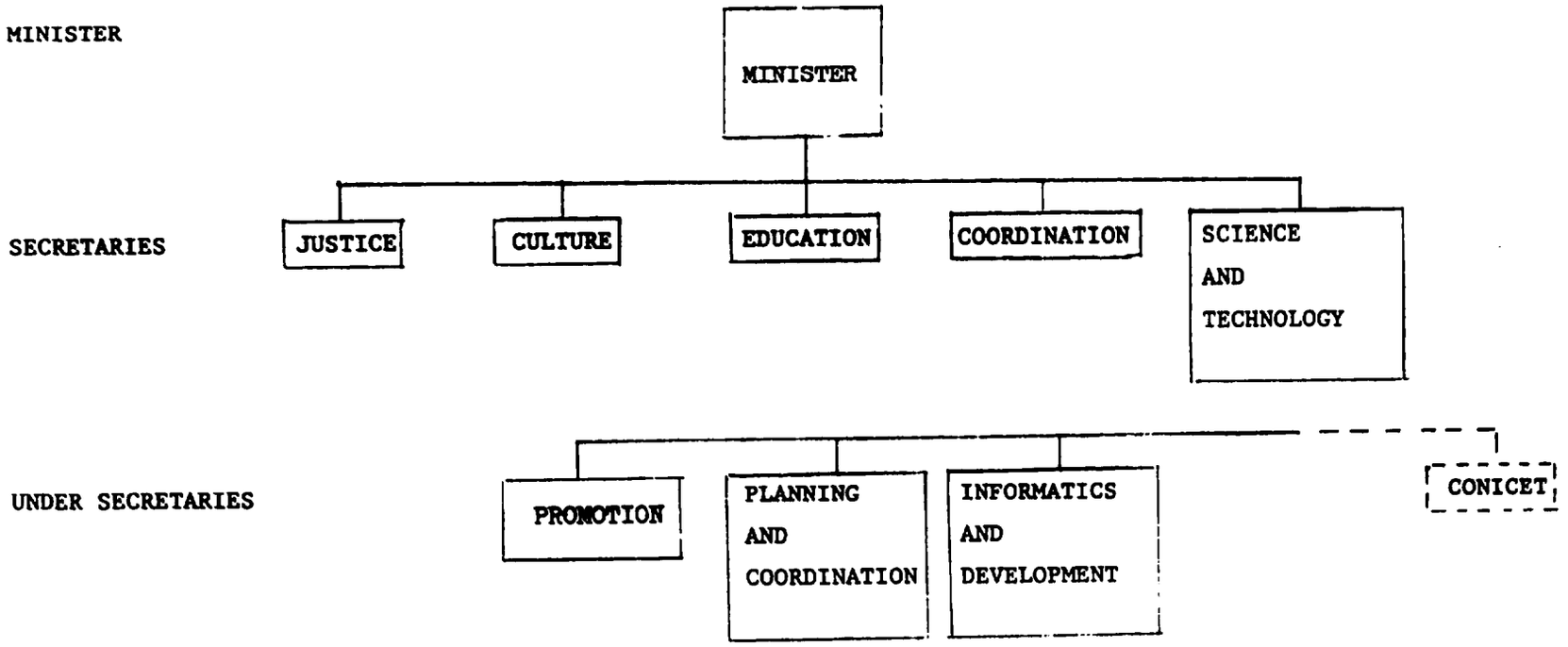
THE COMMUNICATIONS EQUIPMENT MANUFACTURING INDUSTRY

	Total	Leaders	Large	Medium	Small
1. Manufacturers of Equipment (March 1981)	36	2	4	7	23
2. Turnover (1980) (in millions US$)	300	230	37	15	18
3. Employment (March 1981)	7,400	5,300	950	550	600
4. Professionals (March 1981)	320	170	90	35	25
5. Development of Products/Processes (1980) (Man-Months)	475	350	60	20	45
6. Utilisation of Productive Capacity (1980)	70%	83%	65%	40%	35%

ORGANOGRAMME - GOVERNMENT (EXECUTIVE)



ORGANOGRAMME - MINISTRY OF EDUCATION & JUSTICE



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