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07686

Distr.
RESTRICTED

UNIDO/ICIS.4
5 September 1977

ENGLISH

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

POSSIBLE AREAS OF COLLABORATION AND COMPLEMENTARY ACTIVITIES BETWEEN UNIDO AND OAS IN TECHNOLOGY TRANSFER, WITH PARTICULAR REFERENCE TO LATIN AMERICA 1/

by

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id.77-6542

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INTRODUCTION

1. Following the exchange of correspondence and meetings between Dr. Marcelo Alonso, Director, Department of Scientific Affairs, Organization of American States (OAS), Washington, and Mr. G.S. Couri, Deputy Director, IOD, in UNIDO and staff members of the Technology Group of UNIDO, it was decided to conduct a study to identify and define possible areas of collaboration and complementary activities between UNIDO and OAS in the field of technology transfer, with particular reference to Latin America. For this purpose, the services of the undersigned consultant were recruited for the period from 11 July to 15 August 1977.

1.1. The consultant was briefed by Mr. Enrique Aguilar of the Technology Group in UNIDO regarding the scope of the study on 11 July in Vienna and also subsequently by Mr. de Mautort, Chief, Industrial Information Section, UNIDO. The consultant then proceeded to Washington and had detailed discussions with the concerned staff members and experts of the OAS during 18 - 21 July. A list of the officials contacted in OAS is enclosed as Appendix I. Mr. Salzman provided an excellent over-all view of the functions and pattern of working of the OAS, together with the relationships with other international bodies. The latter aspect was further elaborated by Mr. Davis in terms of specific programmes of co-operation. From both these meetings, it appeared that there was a keen desire in the OAS to work in collaboration with other international agencies, such as UNIDO, and even pending any formal arrangement between UNIDO and OAS, it should be practicable to evolve a sound working relationship in areas of mutual interest. It was understood that the Secretary General of the OAS would visit Vienna in October 1977, when this matter may be discussed further with the Executive Director, UNIDO, and his colleagues. This positive response was further strengthened in the more detailed discussions held with Mr. Michael Greene, Deputy Director, Department of Scientific Affairs,

Mr. Carlos Martinez Vidal (Acting Chief, Technical Unit on Technological Development), Mr. Erwin Fetzer (Chief, Technical Unit on Technical Change and Transfer of Technology) and Mr. German Framinán from the Unit on Scientific Policy and Planning. All these three units, presently constituting part of the Department of Scientific Affairs of OAS, are closely connected with technology transfer and very meaningful and detailed discussions were held with these staff members, together with Mr. Zoltan Szabo of the Industrial Development Programme Unit of OAS. Further discussions were held in Vienna on 29 July and the first week of August 1977 with Mr. W.H. Tanaka, Acting Head, Development and Transfer of Technology Section and other officers of this Section and other concerned Sections of UNIDO.

1.2. The consultant would like to record his appreciation of the unstinted assistance and co-operation received from the staff members of UNIDO associated with this study and staff members and experts of the OAS, who made all necessary material and information available and also held frank and detailed discussions on the various subjects covered.

1.3. The scope of the study is intended to cover possible areas of co-operation between UNIDO and OAS, with particular reference to (a) the role of Latin American institutions in the field of technology development and applied research, (b) the promotion of local engineering and consultancy services, (c) identification of UNIDO's inputs to strengthen local technological infrastructure, with particular reference to national offices of technology acquisition, investment authorities and National Councils on Science and Technology, (d) identification of the possible role of the UN in supporting national programmes in the field of science and technology, (e) identification of technological requirements at the national level and (f) identification of technological information requirements at the national level concerning selection of technology, with particular reference to iron and steel, fertilizers, agro-industries and agricultural machinery, which sectors have been selected for the

pilot activities of the Industrial and Technological Information Bank, in pursuance of GA resolution 3507.

1.4. The report is divided broadly into two parts. The first part describes the background and present programmes and activities of the OAS in the field of technology transfer and scientific and technological (ST) development in Latin America (LA). The second part deals with the specific areas in which collaboration and complementary activities between UNIDO and OAS are considered to be both practicable and desirable.

2. SUMMARY

2.1. Scope of study: The study is intended to define areas of collaboration, co-operation and complementary activities between UNIDO and OAS in the field of technology transfer, with particular references to Latin American (LA) countries and covering the role of LA technology and research institutions, promotion of consultancy and engineering services, strengthening of institutional technological infrastructure and information services in these countries and the role of international bodies in developing institutions dealing with technology transfer.

2.2. Activities of OAS in technology transfer: The Department of Scientific Affairs in OAS has, in recent years assisted several projects in LA countries, particularly for (a) establishment and development of Centres of Information and Technical Assistance; (b) sectoral studies in food industries, utilization of bye-products of the sugar industry, marine resources, coal utilization, petrochemicals, electronics and other branches and industrial services, such as metrology, standardization, etc.;

(c) studies on policy and other implications of technology acquisition and transfer; and (d) studies on various regional aspects. A Pilot Project on Transfer of Technology undertaken over a 4-year period (1972 to 1975-6) highlighted several policy and programming implications. A working group of experts from LA countries are at present studying and developing a programme of co-operation in the creation, adaptation and transfer of technology, under OAS auspices. The studies, seminars and working groups of the OAS have focused attention on most of the critical issues and aspects of technology transfer to LA countries. These activities could be further elaborated by (i) closer examination of the relationship and implications of foreign investment and technology; (ii) assessment of technological requirements at macro level and in relation to priority and critical sectors of national or regional growth; (iii) development of technological services capability, particularly engineering and designs; (iv) development of policy package in relation to investment and technology at various developmental stages and (v) analysis of policies, programmes and experience of developing countries in other regions, particularly certain Asian countries.

2.3. Areas of co-operation and complementary activities between UNIDO and OAS:

2.3.1. The wide-ranging programmes of UNIDO in industrial development and the programme of activities of OAS in the field of scientific and technological development suggest a close degree of co-operation and collaboration in activity-programmes relating to technology transfer in Latin America. Such co-operation is necessary so as to avoid duplication of efforts and inconsistencies in approach.

2.3.2. The nature of UNIDO/OAS collaboration should extend to (a) exchange of documentation relating to technology transfer; (b) participation, through staff personnel or experts in working groups, seminars and workshops, convened by either organization and (c) undertaking of joint or complementary projects and studies, particularly for Latin American countries. A small cell should be set up in the Industrial and Technological Information Bank or in the Technology Group of UNIDO to remain in close or periodical touch with the Department of Scientific Affairs of OAS to work out the

detailed programme of collaboration in respect of exchange of documentation and participation in working groups and seminars. As for joint or complementary projects relating to technology transfer, these could be considered in the fields described hereafter.

2.4. Determination of technological demand and requirements:

Several sectoral studies have been made in respect of LA countries through UNIDO, as also ECLA. The organizations should keep themselves informed of these projects and there should be sharing of documentation on projects and studies completed and those underway. If a particular sector is covered by projects of more than one organization, these should be complementary and should not cover similar ground. A joint study should be undertaken by UNIDO and OAS to assess the specific technological gaps and requirements in Latin American countries of certain basic and priority growth sectors. Initially, such a study could cover (i) iron and steel and basic metals; (ii) fertilizers; (iii) chemicals and petrochemicals; (iv) capital goods, including agricultural machinery and (v) agro- and food industries.

2.5. Role of technology institutions in LA countries:

2.5.1. The OAS is assisting a large number of institutions, dealing with technological information and research to develop these units as focal points in an information network. A closer link should be established with the information services provided by UNIDO, which will be substantially expanded with the activities of the Industrial and Technological Information Bank, so that an appropriate information network could be set up in LA countries. The details of collaboration between the UNIDO Information System and the technology information institutions being assisted by OAS should be finalized in a meeting between representative of INTIB and the OAS (Information Section).

2.5.2. The UNIDO should also initiate a study to define the specific role of institutions directly and centrally covered with technological development and their interrelationship with other governmental and non-governmental agencies. A complementary study of this aspect should be taken up by OAS for LA countries.

2.5.3. The UNIDO and OAS should exchange information and experience regarding their assistance to institutions dealing with technological information and research. A joint UNIDO/OAS study should be undertaken to assess the technological impact of such institutions in LA countries.

2.6. Technological infrastructure - development of engineering and consultancy services:

2.6.1. A large volume of detailed engineering in LA countries is still being done by foreign engineering and consultancy companies. It is necessary that, apart from an up-to-date classification of consultancy services available, a realistic assessment is made as to the engineering and other services that can be performed by national units and identification of specific gaps in this field, together with measures to cover such gaps. A clearly-defined policy is necessary regarding the use of national consultancy and engineering services.

2.6.2. The identification of gaps in technological services has to be done initially on a country-wise basis and for critical and priority sectors, such as chemicals and petrochmeicals, fertilizers, basic metals and heavy capital-goods production. This can be done through a joint UNIDO/OAS study, using national institutional agencies in Latin America. Thereafter, gaps in such service capability should be defined for the Latin American region as a whole, again for the same or other priority sectors. The extent to which preferential treatment would be necessary for national and regional engineering consultancy services and would be forthcoming would also need to be assessed and policy norms prescribed

regarding the use of national consultants and domestic engineering capability. An aspect also to be analyzed is the nature of technical and financial support, including subsidy, that may be necessary to national consultancy firms undertaking detailed engineering in sophisticated production sectors.

2.6.3. The growth of adequate manpower skills is an essential aspect of technological infrastructure. Both UNIDO and OAS are implementing several training programmes and it would be desirable to exchange information and details regarding their respective programmes in this field. It would also be desirable to undertake a joint UNIDO/OAS study of training requirements for LA countries in respect of (a) managerial/supervisory personnel in industrial enterprises and technology institutes; (b) engineering and design personnel and (c) decision-makers in the field of industrial and technology policies, and thereafter take up an expanded programme to cover (a) and (b) through in-plant and in-institution training, both in developed countries and in developing countries of other regions, particularly Asia, and through regional workshops in the case of (c).

2.7. Technology policy

2.7.1. A number of policy instruments have an indirect or direct impact on technological developments. Those having an indirect effect cover a large field including industrial licensing, export incentives, tax relief and the like. The principal institutional instruments in LA countries which have direct impact on technological development are (a) Councils of Science and Technology; (b) National regulatory bodies for foreign investment; and (c) National Registries regulating foreign technology. The technological impact of the programmes of the Councils of Science and Technology need to be jointly assessed by UNIDO and OAS.

2.7.2. As for the investment agencies it is suggested that UNIDO should undertake a comparative study of foreign investment policies of selected developing countries and assess their impact on technological development, particularly policies relating to existing foreign subsidiaries or affiliates, with OAS commissioning a similar study for Latin American countries.

2.7.3. In respect of National Registries on Technology, several studies have been made by UNIDO and OAS regarding the present working of these bodies. It is necessary in future, however, to consider these agencies in more dynamic terms than merely as regulatory agencies and to expand the functional role of these and similar institutions very substantially. The expanded and continuing role would include analysis of the impact of foreign technology in various sectors, extent of absorption and adaptation achieved, determination of sectors where further inflow is considered unnecessary or undesirable and sectors where inflow is necessary and needs to be ensured, assessment of unutilized patents and critical aspects. An important area of UNIDO/OAS collaboration would be to review and determine in this context, the future role of National Registries and other agencies concerned with technological change in Latin America.

2.7.4. Exchange of information and experience of Registries of Technology and like institutions is very necessary. The extent and nature of information to be pooled regarding various technology contracts approved/rejected by the various Technology Registries in Latin American countries would be a very useful area for a UNIDO/OAS study.

2.7.5. A number of fiscal and regulatory policy instruments also have a direct impact on technological development and a detailed analysis of such measures is necessary, particularly for LA countries. An important area for further analysis by UNIDO in collaboration with OAS for LA countries is the determination and analysis of various fiscal and regulatory policy measures which have a direct impact on technology and indigenous R+D.

2.8. Identification of technological sectoral requirements:

2.8.1. Technological requirements at the macro level for an economy have to be assessed in the light of growth projections for priority sectors and the consequential technological needs in respect of processes and know-how, technological services and the necessary infrastructure for selecting, negotiating and acquiring appropriate technology on suitable terms, on the one hand and effective absorption and adaptation, on the other. While the

basic infrastructure elements remain the same, these would vary considerably with different inter-sectoral priorities over given periods.

2.8.2. A detailed sectoral planning exercise, covering all branches is not essential. Where this is available, technological needs can be spelt out more accurately but even if broad priorities are identified, as is possible in most LA countries, technological requirements can be adequately assessed. It would be desirable for UNIDO, with the assistance of OAS and national governments to collate information regarding the sectoral studies already undertaken and to outline a programme of sectoral growth priorities for the Latin American region for the period 1980-5. This could then be further considered by national governments or at a regional level. Thereafter, a technology development programme could be outlined to cover the identified requirements for an approved programme of sectoral priorities.

2.8.3. The results of in-depth UNIDO studies, undertaken for a number of sectors should be brought to the attention of LA countries. To the extent that OAS may be interested in undertaking case studies in these sectors in LA countries, they could be associated.

2.8.4. Sectoral technological requirements also need to be assessed at regional level, as suggested earlier. These would constitute a pre-requisite for collective bargaining for acquisition of technology.

2.9. Role of international agencies, particularly UNIDO in developing ST at institutional level:

2.9.1. While a number of international and inter-regional bodies have taken up programmes for ST development in one or other sphere, the UNIDO's role is critical in development of institutions related to ST in manufacturing industry. This has to be considered in the light of the role of various institutions concerned with technology policies, identification

of technological needs, development of technological infrastructure, including manpower resources, information services, selection and acquisition of appropriate technology, and development of R and D activities.

2.9.2. In respect of technology policy, UNIDO should undertake a detailed study to define the various ingredients of a comprehensive technology policy for the manufacturing sector.

2.9.3. With regard to technological requirements, concerned institutions have to be identified, both a macro and micro level, their roles defined and their programmes reviewed, so as to ensure comprehensive coverage. Appropriate mechanisms should also be defined, where these have not been set up.

2.9.4. For assessment of technology infrastructure gaps, an institutional network should be defined for various developmental stages. Guidelines should be laid down for classification and assessment of national consultancy services and suitable mechanisms evolved for identification and removal of gaps in such services, particularly engineering and design capability and certain basic industrial services. Mechanisms should also be defined for meeting inadequacies in specialized manpower resources.

2.9.5. An appropriate information network should be devised at national and regional levels which can be adopted to national needs. This should serve, inter alia, as a data bank for industrial and technology planning at macro and micro levels.

2.9.6. A suitable framework and mechanisms should be evolved to evaluate, select and assist in the acquisition of appropriate technology, this role being considered distinct from regulatory functions. The detailed institutional functions should be defind and UNIDO should undertake a specific study to define the institutional role and responsibilities in this regard.

2.9.7. An appropriate institutional framework should be drawn up for assessing and assisting the process of absorption and adaptation of acquired technology. The powers and functions of such vis-à-vis national enterprises should be defined. The policy aspects of enterprise-level R and D activities should also be analyzed in this context.

2.9.8. For certain sectors, such as development of new energy sources or branches of particular interest of developing countries, new technologies and processes would need to be explored. The institutional requirements and nature of R and D projects should be defined and assistance programmes drawn up.

2.9.9. The above role outlined for international agencies, particularly UNIDO, to develop technology institutional aspects in developing countries should be supplemented by a similar programme by regional bodies such as the OAS.

2.10. In order to effectively tackle both the institutional and functional problems of technology transfer to developing countries a Fund for Development of Industrial Technology should be created in UNIDO, either as a separate entity or as a Sub-Fund of the Industrial Development Fund, which is proposed to be set up.

2.11. Technological co-operation among developing countries

While a suitable climate and infrastructure should be created for adequate inflow of appropriate technology from enterprises and institutions from developed countries on acceptable terms, it is increasingly necessary to ensure greater joint and co-operative action between developing countries in this regard. Joint or collective action can relate to contractual

provisions in investment/technology agreements, exchange of information regarding contracts, selection of technology, bargaining for appropriate technology by a group of countries, development of a technology pool, revisions in patent and trademark legislation, R and D activities in certain sectors and training of personnel. It is also necessary to evolve a net-set of principles or "rules of the game" to guide direct technology inflow between enterprises in developing countries. The UNIDO should examine the detailed nature and possiblities of such technological co-operation and prescribe the principles and standards to be followed in direct technology inflow between developing countries. The OAS could undertake a similar study for LA countries.

A: ACTIVITIES OF OAS IN TECHNOLOGY TRANSFER

3.1. Considerable emphasis has been given in recent years by the OAS to problems of scientific and technological (ST) development in Latin America. A Regional Scientific and Technological Development Programme had been earlier initiated, under which a number of technological studies were undertaken in LA countries and assistance provided for the development of institutes of technological information and research in several of these countries. This programme was supplemented by a fairly comprehensive Pilot Project for Technology Transfer (PPTT), which was undertaken in 1972 and completed in 1975-6, and covered various aspects of technology programmes and requirements, besides focusing attention on several policy issues relating to scientific and technological growth in this region.

3.2. Considerable interest has developed, during the last decade, on the implications of technology acqusition and transfer in several LA countries and a number of studies have been made on various related aspects, including foreign ownership and control, patents, transfer pricing in different branches, the need for and direction of regulatory control on technology inflow and the like. These studies have been considerably supplemented by the programmes and studies undertaken by the Economic Commission for Latin America (ECLA) and the OAS. A number of projects relating to technology transfer and development in LA countries have been undertaken by OAS, particularly during the period 1974-7 and the programme is expanding both in scope and content. The projects cover a wide range of activities designed to develop technology institutions and the technological infra-structure in these countries, besides identifying technological needs for various sectors and at enterprise levels in the LA countries. A list of the major projects, in respect of which OAS assistance exceeded US$ 50,000, is appended at Appendix II. Special emphasis was given to the development of technological infrastructure through projects assisting the establishment and development of Centres of Information and Technical Assistance to Industry

in several countries, including Bolivia, Chile, Columbia, Costa Rica, Rep. Dominicana, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Paraguay, Peru and Venezuela. Most of these units have been set up within the Councils of Science and Technology or like institutions in these countries. The sectoral programmes (Proyectos Especiales Cuenta Mar Del Plata) have primarily concentrated on electronics (Argentina, Brazil, Mexico and Paraguay), coal utilization and gasification (Chile, Columbia, Mexico and Venezuela), petrochemicals (Ecuador and Venezuela), food industries (Argentina, Brazil, Chile, Ecuador, Mexico, Paraguay, Peru and Venezuela), marine resources, including fisheries (in several countries), sugar and its bye-products (in seven LA and Caribbean countries) and wool (Argentina). An important infrastructure activity sought to be developed is metrology, for which OAS project assistance has been provided to ten LA and Caribbean countries, including Argentina, Ecuador, Mexico and Uruguay. OAS assistance has been provided for research in utilization of solar energy in Argentina, Bolivia, Brazil, Jamaica, Mexico and Trinidad and Tobago. Under the Regional Programme of ST development, a large number of projects and studies (over 110) have been assisted by OAS in the various countries of the region, mostly with small grants ranging from US$ 5.000 up to US$ 50,000. A few major projects (OAS assistance above US$ 50,000) have also been undertaken under this programme, including projects relating to metal extraction and transformation and organization of projects and programmes in Brazil, and food technology and metallurgy in Mexico .

3.3. A number of analytical studies have also been undertaken, covering both policy and programming aspects on the one hand and relating to specific industrial sectors on the other. A list of the principal studies, which have been completed, is enclosed as Appendix III. The more general and policy studies have dealt with issues such as the working of the Registries of Technology, formulation of technological requirements, possible lines of action in respect of technological development and the like. The sectoral studies have concentrated principally on technological aspects of the chemical and petrochemical sector, metallurgy

3.4.2. The PPTT's approach of assessing technological requirements only at enterprise level partially perhaps stemmed from institutional constraints. In the final PPTT report, it has been recognized that, at state level, the PPTT contacts were generally found to be more difficult and less responsive. It is, however, at this level that production gaps, and consequential technological requirements, can usually be most effectively identified in the context of national resource endowments and constraints.

3.4.3. It must be stressed, however, that the PPTT study was very useful in identifying technological needs and prospects at the enterprise level in several sectors specifically studied in these countries. Apart from several critical issues highlighted by the PPTT, a methodology for technological data collection and analysis was able to be developed. The various studies conducted as an integral part of this Project in several countries were, in themselves, very useful and brought out a number of policy issues as well as specific sectoral problems. An important contribution was the emphasis given to the growth of technological services, particularly national engineering and consultancy facilities. The Project also focused attention on the constraints and difficulties in obtaining adequate information on technology inflow, absorption and adaptation and the need for sharing of experience amongst these countries. It also directed attention to the necessity of trained and specialized manpower, not only at the level of enterprise operations and management but at decision-making levels in governmental regulatory agencies and technology institutions. The PPTT study also experimented usefully with various approaches to evaluating of technological alternatives in different sectors.

3.4.4. The completion of the PPTT project in 1975-6 was followed by some restructuring of the concerned sections within the OAS and the division of the Department into three units, viz. Information and Technological Change, Technical Development, and Policy and Planning.

The units are, of necessity, closely interrelated and it is essential that a common approach is brought to bear on problems of technology transfer which would inevitably overlap among these units.

3.5. Apart from the several technology development projects and programmes assisted by the OAS, emphasis appears to be shifting to a more policy-oriented approach on technology transfer and related issues, following the decisions of the General Assembly of the OAS and the deliberations of a Working Group of Experts. The activities of the CAS in the field of technology transfer were broadly reviewed in the General Assembly of the OAS at its sixth regular session and the Assembly, vide Resolution AG/RES 233 (VI - 0/76) set up a Working Group of Governmental Experts for the purpose of "studying a programme of co-operation in the creation, adaptation and transfer of technology". The Working Group had its first meeting in March 1977 and is due to have its final round of discussions in September 1977. In its March session, the Working Group discussed the following specific items: (i) co-operation in the field of technology, including principal objectives and possible alternatives for a system of co-operation; (ii) specific aspects of technological development and their incorporation in alternative programmes; (iii) possibilities of integrating programme alternatives with activities of regional and interregional organizations and (iv) financing of proposed programme.

3.5.1. The programme for co-operation was visualized by the Working Group in terms of short-range, middle-range and long-term effects. The short-range programme related to capacity for seeking, evaluating and acquiring technology and principally covered technical information and assistance systems, management aspects and project engineering. The middle-range programme covered design and process engineering and technological adaptation, largely through technological institutes. The long-range effects were visualized in terms of capacity to generate technologies, products and processes and development of research centres.

and agro and food industries. Many of the studies were undertaken as part of the PPTT. Two sectoral studies of considerable interest are an analysis of the foundry industry and of the prospects and utilization of the direct reduction process of iron ore. The study relating to the Atucha (Argentina) power project is also a very useful analysis of the technology-package implications of major power projects.

3.4. The Pilot Project on Transfer of Technology (PPTT) requires to be specifically mentioned. This was an ambitious undertaking covering various aspects and implications of technology transfer to these countries, with special emphasis on the metallurgy, chemicals and petrochemicals and food technology sectors. The PPTT undoubtedly highlighted technology acquisition and transfer as a significant tool for accelerating economic and technological development.

3.4.1. The assessment of technological requirements in the PPTT were, however, based on the needs as assessed at the level of various enterprises though, in several instances, such requirements were defined not only in terms of new or improved processes but new lines of manufacture, such as the production of copper wire, electrolytic condensers, printed circuits and the like. To the extent that such new production activities could be identified by enterprises in one or other of these countries, the PPTT studies were very useful. It is, however, doubtful if an assessment of technological requirements at enterprise-level alone can be exhaustive or comprehensive. Such requirements have necessarily to be assessed in terms of the over-all national economy in a particular country and must be related to existing or potential production gaps and the technological needs to cover such gaps. A macro approach to national technological requirements requires the identification of key and priority sectors and assessment of production and technological gaps in these branches. The identification of priority sectors has been done, in varying degrees of detail, in many LA countries through several governmental agencies, semi-governmental institutions and industrial associations, and sectoral technological needs have to be assessed in the light of projected production requirements.

Of necessity, these programmes would have to be adjusted to the resources and priorities of each country over a period of time. Special emphasis needed to be given to regional co-operation, through regional or supra-national institutions, was not considered advisable. The general guidelines for co-operation included (a) identification of areas of action; (b) ensuring of participation of various agencies involved in technological development, including governments, the production sector and research, engineering and information services; (c) ensuring of linkage of technology suppliers and recipient enterprises; (d) improvement of technology transfer processes and absorption thereof; (e) improvement of productivity; (f) promotion of lateral transfer of technology among Latin American countries; (g) promotion of links between technological development institutes and research bodies; (h) ensuring of flexibility of programme ,but designing around recommendations of other regional and international bodies.

3.5.2. A number of specific areas of action were suggested on behalf of the various participating countries. These varied from country to country, depending on the level of growth and the nature of problems that had developed in each economy.

3.5.3. The OAS Secretariat was required to prepare an inventory of the technical information system in operation at the inter-American level with details as to technical areas covered and other relevant data, together with an inventory of scientific and technological research and development centres operating in the region.

4. A Follow -up Committee of the Working Group met subsequently in April 1977 and considered the programme of action in greater detail. In its recommendation, it reiterated the objectives of an inter-American co-operation programme for the development, adaptation and transfer of technology. Principal stress was given to the achievement of the defined objectives through increasing ST capability in each country so as to (a) resolve specific technological problems; (b) ensure the setting-up

of adequate technological services and strengthen capability in selecting and negotiating the acquisition of particular technologies; and promote technological innovations at enterprise level and (c) assist in attaining economic and social development objectives. Specific areas of action were defined as: (i) Institutional support for technological development, covering growth of technological institutions, liaison between such units, training of specialized manpower and assistance for technological services. Such a programme would essentially be supplementary to the Regional Scientific and Technological Development Programme and other existing programmes of the OAS. Particular stress was laid on training specialized manpower, both at enterprise management and operation level and policy-making and governmental level; (ii) Technical assistance for providing technological services such as information, engineering and consultant services, technical and managerial assistance for firms, and metrology, standardization, rationalization and quality control. This would include support activities for setting-up and operating national institutions for regulation and use of technology and determining technological requirements; (iii) Support action for utilization, absorption and adaptation of technology at both governmental and enterprise level. This would include both the determination of technological requirements in terms of demand and priority and the acquisition of foreign technology on the most favourable terms. An important recommendation relates to the need for structuring a financial co-operation system to mobilize adequate resources.

4.1. The Follow-up Committee stressed the need for a flexible approach to adapt to the varying needs of the participating countries but felt that, subject to such flexibility, a co-operative programme could be evolved, both at national and multinational levels. For this purpose, existing policy and institutional instruments would need to be reviewed and new instruments may need to be evolved, so that an adequate mechanism can be designed for a technological co-operative programme in the region.

4.2. In the light of the recommendations of the Follow-up Committee, the OAS Secretariat is presently preparing a detailed paper for consideration of the Working Group meeting in September 1977.

5. There can be little doubt that considerable useful work has been done in the OAS in respect of technology transfer in Latin American countries and that the programmes under consideration through the Working Group would have comprehensive coverage. Apart from much greater awareness having developed in these countries on various critical aspects of technological growth, a number of ST institutions have been set up or expanded their facilities considerably in several Latin American countries. These institutions provide focal points for study of various technological issues and problems in these countries. A list of such institutions which have been assisted by the OAS and through various projects under the Regional Programme is enclosed at Appendix IV, together with the information and technological services that these institutions are able to provide in their respective countries. The information and technical assistance network of the OAS is largely channelised through these institutional agencies and supplies technical information and assistance services to business (SIATE) and Information Systems for Management, which are very useful to industrial and business enterprises. The various studies undertaken in the OAS and through the PPTT and the special projects financed by the OAS have been very useful and have pinpointed the attention of both policy-makers and enterprises to various facets and implications of technology transfer and development. The seminars and inter-governmental meetings organized by the OAS have also served to focus attention on critical policy aspects and have had significant consequential impact on technology policies in several Latin American countries.

6. While the activities of the OAS in this field have been very useful and significant, increased emphasis on certain basic and related issues could render the OAS programme even more realistic and meaningful. Some of these aspects are briefly mentioned hereafter. (a) Technological development cannot be considered in isolation and must be viewed as closely interlinked with investment policies and programmes. National technological development must be considered as an integral part of the investment process, particularly in relation to the inflow of foreign capital. A carefully-conceived policy for indigenous technological development in a particular industrial sector may become very diluted if, for example, foreign investment through transnational corporations is freely permitted in that sector, as such investment would inevitably bring foreign technology in its wake. Similarly, a highly restrictive policy on foreign investment may result in consequential restriction on inflow of particular technology which may be considered very necessary. (b) Technological requirements must be assessed, both at the macro level of the economy and at the micro level of the production sector, as represented by existing enterprises. Conclusions on technology policies based only on the latter may tend to be misleading. (c) The determination of technological requirements at a macro level for an economy necessitates close linkage and co-ordination between governmental agencies dealing with planning or the setting of priorities for industrial growth and institutions and agencies dealing with technological growth. At present, many of the institutional agencies serving as focal points for OAS programmes have only a limited role in the determination of sectoral priorities. (d) The development of technological infrastructure, particularly engineering services, both at national and regional level in Latin America requires greater emphasis and support. (e) A policy package incorporating these aspects needs to be evolved for various stages of development in Latin American countries. Such a package would obviously

need to be realistic in terms of the basic objectives of industrial growth and define parameters for regional co-operation. (f) Technological requirements have to be assessed at sector level, both for particular countries and for the Latin American region as a whole. While a number of OAS-assisted projects relate to industrial and infrastructural branches, most such studies (with some notable exception) have been directly related to sectoral technological needs only to a limited extent. (g) While OAS studies have dealt with Latin American experience, most of these studies have not drawn adequately from policies, programmes and experience in developing countries from other regions. These could constitute a very useful feedback of practical experience. Considerable knowledge and experience is available in several Asian countries, in particular, where many critical aspects of technology transfer have been dealt with, for some time. Similarly, experience of LA countries should be made more fully known to developing nations of Asia and Africa. A two-way flow of more detailed informtion should be ensured through UNIDO. Closer contacts between personnel and experts from different developing regions should also be encouraged through UNIDO and OAS programmes in this field.

7. The UNIDO's role in industrial growth is inevitably much broader in scope, as its objective */ is to co-ordinate the activities of industrial development, particularly the building and strengthening of institutions, management and administration of industrial technology and dissemination of information on technology innovations and developments. The Second General Conference of UNIDO has re-emphasized UNIDO's specific responsibilities in the field of technology transfer, in the formulation of an international Code of Conduct in co-operation with UNCTAD and, inter alia, in adoption and improvement of commercial practices governing transfer of technology to the needs of developing countries and in improving access to information sources regarding appropriate industrial technology. UNIDO is also in the process of evolving a technical information exchange network and an Industrial and Technological Information Bank. A programme of special significance relates to co-operative action on appropriate industrial

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*/ UNIDO in the Field of Technology Transfer - DP/3/Ref.1

technology. A specialized unit dealing with development and transfer of technology has been set up to deal with selection and acquisition of technology , identification and adaptation of indigenous technologies, development of appropriate technologies and policies on industrial technology, while the Information Section is dealing with the Technological Information Bank. A programme being accorded special emphasis in UNIDO is that of increasing economic co-operation between developing countries. This would also necessitate maximum flow of information, particularly on technological developments between these countries.

B. SCOPE FOR COLLABORATION AND COMPLEMENTARY ACTIVIES

8. The coverage of programmes and projects relating to technology transfer in UNIDO and OAS suggests the obvious need for close collaboration between these two organizations in so far as activities in Latin America are concerned. Not only is such collaboration practicable and desirable but this appears very necessary in order to avoid duplication of activities and possible inconsistencies in approach. Both organizations could supplement their field activities and ensure adequate co-ordination as well as significant expansion in the scope and content of these programmes.

8.1. The nature of UNIDO-OAS collaboration should broadly extend over three fields: (a) exchange of documentation relating to technology transfer; (b) participation through personnel/experts in working groups, seminars and workshops relating to S/T and technology transfer called by either organization and (c) undertaking of joint or complementary projects and studies, particularly for Latin American countries. The first two activities should not present undue difficulty and a small cell in INTIB or the Technology Group of UNIDO should be designated to remain in close and periodical touch with the Department of Scientific Affairs of OAS to work out the detailed programme of collaboration on these two aspects. The joint or complementary activity programme, however, needs more detailed consideration.

9. The specific areas of joint or complementary activity between UNIDO and OAS have to be assessed in relation to the basic features and needs of technological development in Latin American countries. These features can be broadly classified under the following heads: (a) determination of extent and nature of technological demand; (b) assessment of the role of LA institutions in technological development and applied research and in building an adequate information and monitoring system regarding technological needs, capability and development programmes; (c) development of technological infrastructure, particularly engineering and consultancy services and manpower skills; (d) determination of a policy framework, with particular reference to national offices of technology acquisition, investment authorities and councils on science and technology in LA countries and defining of UNIDO and OAS inputs in this regard; (e) identification of technological needs in key sectoral levels, particularly iron and steel, fertilizers, agro-industries and agricultural machinery; and (f) determination of the role of international agencies in respect of growth of ST at the national level in LA countries.

10. Technological demand and planning must be considered both in terms of the economy as a whole and in relation to the specific technical needs of the production sectors as represented by existing enterprises. From a macro viewpoint, this necessitates the determination of strategic and priority industrial sectors where production and technological gaps may exist at a period of time. In many LA countries, such sectors have been identified through agencies directly or indirectly involved in industrial planning. Priorities may shift in emphasis on basic objectives during different periods but investment priorities would directly relate to technological demand in the identification sectors. This, in turn, would have to be broken down in terms of sectoral technological demand.

11. UNIDO has, for several years, been involved in sectoral industrial planning in many LA countries. The capital-goods development programme undertaken in Mexico by UNIDO in collaboration with Nacional Financiera

is an excellent example of identification of production and technological gaps in a critical sector. Similar projects have been undertaken for iron and steel, foundries, metallurgical industries and other industrial sectors in one or other country. The OAS should keep itself informed of these projects and documentation should be shared on completed and on-going projects. Duplication of activities between UNIDO, SELA and OAS should be avoided and if projects relating to a sector are undertaken by more than one agency, the scope of the study should be complementary and not cover the same ground. A joint regional study should be undertaken to assess the technological gaps and requirements in LA countries of certain basic and priority growth sectors. Initially, such a study could cover (i) iron and steel and basic metals; (ii) fertilizers; (iii) chemicals and petrochemicals; (iv) capital goods including agricultural machinery and (v) agro- and food industries. Considerable information necessary for such a regional study is already available with UNIDO and with the OAS and a study of this nature would further highlight the needs at national level in these countries.

12. Role of technology institutions in LA countries

12.1. There is considerable multiplicity of institutions in most LA countries dealing with technological information, investigation and research and development. These can be broadly classified under (a) National Councils for Science and Technology, designed principally for policy-making and co-ordination of ST policies and programmes; (b) Centres of technical information, investigation and research, ranging from purely information centres to large, multi-disciplinary R and D organizations; (c) National Agencies dealing with specific programmes or services, such as productivity, metrology, standards, quality control, etc.; (d) Research Centres in various universities, concentrating usually on specific branches; and (e) Centres of Technology and applied research for industrial sectors such as petroleum, metallurgy, food and agro-industries, textiles, marine products and the like. Many of these institutions are relatively new and are gradually expanding their activities beyond studies and analysis. Such institutional activities are usually supported by the governmental or university funds, though the OAS and other international and regional organizations have financed a large number of specific studies. OAS assistance has also been provided for

developing, within this framework, centres of industrial information in several countries.

12.2. The technological impact of these institutions, with notable exceptions, has been rather limited, principally because of inadequate communications and linkage with the production sector. The latter, partly because of the influence of foreign capital investment, has tended to rely largely on external technological links, as these appear easier in practice and timing and are usually more rewarding commercially. Even the flow of information from enterprises is often limited and partial. Enterprises have also utilized national research units only to a very limited extent in resolving technological problems. This, in turn, has slowed the growth of these institutions as centres of research applicable to industry. With greater stress on national S/T development, the pattern is gradually changing but the process is slow and needs to be accelerated. The commercialization of R&D results has also had very limited success, again primarily because of the inadequate linkage with industry and as many of these institutions are still in the process of evolution and adjustment to national technological needs. At the same time, the units dealing with specific services such as productivity, metrology and standards, have had considerably greater success and impact.

12.3. The institutional experience in LA countries should be compared to that of developing countries in other regions. Some of these programmes have been very successful, as in the case of the Republic of Korea, where the Korea Institute of S/T (KIST) undertook over 200 contracts valued at US$ 7 million in 1974, of which 51% came from industry. */ Information and experience of such organizations could be of considerable use to Latin American institutions. Fairly close ties have been developed between some LA institutions and those in developed countries, particularly

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*/ Reference is invited to "Guidelines for development of industrial technology in Asia and the Pacific". ESCAP, UN Centre, Bangkok 1976.

USA, U.K. and Denmark. These have proved very useful but closer linkage with institutions in other developing countries would also be of great advantage as the nature of problems would be more similar.

12.4. The over-all institutional mechanism should essentially provide both an information network and a structure for operations and applied research. The information system should ensure (i) a flow of data and material regarding production and technological requirements projected over a period of time (usually a plan period of 3 to 5 years) at the macro level of the economy and (ii) specific technical needs of the existing national production sector. Information relating to the former would, for the most part, emerge from other organizations such as planning agencies, Ministries of Industry and chambers of commerce and the like, though technology institutions should also effectively participate in the determination of such programmes and priorities. Once the nature and magnitude of the programme is broadly defined, the technological needs have to be analyzed in terms of (a) possible technological sources, both indigenous and foreign; (b) evaluation of alternative technologies in relation to national resource endowments and policy objectives and selection of appropriate technologies; and (c) determination of policy guidelines for negotiating and securing appropriate technology. Thereafter, emphasis shifts to the enterprise level, in respect of existing units and new units as are necessary.

12.5. At the micro or enterprise level, the institutional mechanism should provide for adequate flow of data regarding existing industry in terms of (a) production capacity in various or selected sectors, production techniques employed, utilization of capacity and technical problems being faced; and (b) nature of expansion proposed, with its technological implications. It should also provide for flow of information in respect of new enterprises which need to be set up to cover critical production gaps, including (a) the size and structure of such units; (b) the nature of

technological requirements; (c) selection of appropriate technology; (d) negotiations and acquisition of technology; and (e) the establishment, commissioning and working of the enterprise. This should be followed up by monitoring and analysis of the effectiveness of absorption and efforts towards adaptation of technology, if imported technology has been utilized and further technological improvements and innovations in the case of indigenous technology. While a comprehensive information system is essential for an over-all technology plan, the research-industry linkage becomes particularly significant at the enterprise level, both in meeting technical problems as they arise and in assisting in absorption and adaptation of foreign production techniques. This is not to suggest that technology and R&D institutions should not undertake basic technological research. This must proceed simultaneously, as is already taking place in several developing countries, often with marked success. Technology institutional programmes must, however, be based on identified needs of the economy and of the production sector. Technological exchange through joint ventures and licensing arrangements is today a very common phenonomenon and inflow of appropriate technology on suitable terms should be dovetailed in a nation's S/T development programme, with emphasis on adequate absorption and subsequent adaptation of such techniques in the form of innovations and new products and processes.

12.6. The wide coverage suggested above would inevitably mean close co-ordination between a number of institutional agencies. This aspect is dealt with subsequently and it only needs to be emphasized at this stage that the national information network should be comprehensive and should preferably be centralized. Whether or not it is located within the central institution or agency dealing with technological development is not so important; what is essential is that technology institutions should have constant access to such data in evolving the national technology plan and strategy both at the macro level and at the level of enterprises.

12.7. UNIDO has developed a fairly extensive system of industrial and technological information which could be usefully utilized both by the Information Section in OAS and by the various Councils of Science and Technology and Centres of Information in LA countries. Hitherto, UNIDO activities had concentrated on (a) "Your questions answered" - covering all branches of industry and various levels of planning, besides operational problems experienced in developing countries, the service being provided through a network of correspondents and consultants; (b) "Guides to Information Sources" - providing addresses of relevant organizations, information services, statistical sources and the like for various sectors ; and (c)"Industrial Development Abstracts" - being compilations of publications, feasibility studies, papers and reports of various seminars held under UNIDO auspices and extending to over 7000 documents on microfiche. These services are apart from the Library and Documentation Unit of UNIDO. A new dimension would now be given to UNIDO activities with the setting up of an Industrial and Technological Information Bank (INTIB). This unit would be concerned with the selective processing of technological information and assistance in assessing and applying such data, including on-site technical advice. Such information would also provide the data base for a Co-operative Programme of Action on Appropriate Industrial Technology and for sectoral consultation meetings. Initially, detailed technological data and information is being collected and processed for 4 sectors viz fertilizers, iron and steel, agro-industries and agricultural machinery. Such information would, in the initial period, be available to selected institutions in developing countries. The pilot activities */ would, inter alia, cover the collection of selected information for the chosen sectors, creation of a network of information, establishment of linkage with users, preparation of technological profiles, identification of technological sources and capabilities in developing countries and the like.

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*/ ID/B/183 - Establishment of an Industrial and Technological Information Bank, UNIDO paper, April 1977

The expanded information facilities to be provided through INTIB should be co-ordinated with the activities of technological institutions in Latin America, including those listed in Appendix III. The OAS Information Section could suggest to these institutions to establish direct links with the INTIB, so that a two-way flow of technological information could be ensured. These institutions, among others, could serve as the information centres of the INTIB in Latin American countries.

12.8. A meeting should be held between representatives of INTIB and the OAS (Information Section) to finalize the details of collaboration between INTIB and the LA institutions served by OAS.

12.9. Both UNIDO and OAS are financially assisting several institutions engaged in technological research. The UNIDO has, at present, 32 on-going large-scale projects covering infrastructure institutions such as for standards and for industrial R+D to sectoral and multi-purpose R+D institutions for engineering, metallurgical, chemical, agro-industries and other specific industrial sectors. Besides, over 40 small-scale projects of assistance to various institutions are also being implemented. OAS is also similarly assisting a number of technology and research institutions in Latin America. It would be useful to exchange experience and undertake a joint study regarding the effectiveness of these programmes in Latin America and to assess the impact of such institutional activities in the respective industrial branch. While the extent of financial and technical support to these institutions needs to be substantially enlarged, a closer analysis is necessary to define the specific role of these institutions and the direction and nature of their activities in technology transfer, absorption and adaptation and their relationships with other agencies and institutions involved with investment and technology policy and programmes. With multifarious agencies involved in the policy and programming field in most developing countries, the task of delineation of role and functions and of effective co-ordination is a very real one and a systematic study and definition of the appropriate organizational relationships would be very useful. It is, therefore, suggested that UNIDO should initiate a study to define the specific role of institutions directly and centrally concerned with technological development and their interrelationship

with other governmental and non-governmental agencies involved in national developmental policies and programmes. A complementary study should be taken up by OAS for Latin American countries. Such analysis would enable not only a more effective review of the assistance for such institutional programmes but would serve to define institutional responsibilities in technology transfer in more definitive terms. UNIDO, jointly with UNDP, is presently taking up a detailed evaluation of UNIDO projects of assistance to research and development institutions. The results of such evaluation may prove to be of considerable value to OAS in reviewing its own programme in this regard.

12.10. Pending the completion of such evaluation (October 1978), it would be useful for UNIDO and OAS to exchange information and experience regarding their projects for assistance to such institutions in Latin America. Thereafter, a joint UNIDO/OAS study should be undertaken regarding the technological impact of such institutions in Latin American countries.

13. Technological infrastructure-development of engineering and consultancy services

13.1. Inadequate technological services capability constitutes a major constraint in most developing countries. Technological services range from macro-level industrial planning to micro-level project identification, feasibility studies, detailed engineering and designs, plant specifications, civil constructions and machinery installation and commissioning, start-up and plant operations. The most significant gap in Latin American countries is in respect of detailed engineering and designing and competent sectoral consultancy services through nationally-owned units. This makes disaggregation of imported technology"packages" more difficult and leaves a critical infrastructure area inadequately covered. This aspect has been recognized and highlighted in several UNIDO studies and also in the PPTT report of OAS.

13.2. Considerable information is available on the over-all availability of various types of consultancy services in these countries. UNIDO's roster of consultants also includes a fairly comprehensive list from Latin American countries. The CODELCA meeting in Mexico (1975) also produced a long list of consultancy services available in different sectors. What is, however, necessary, apart from an up-to-date classification of such services, is a realistic assessment as to the specific engineering and other services that can be performed by national units, the identification of specific gaps in this field, particularly with regard to detailed engineering and designing, and the implementation of a programme to cover such gaps. The objective to be aimed at should be that, while process or manufacturing know-how may be imported in defined sectors through joint ventures or licensing arrangements, other ingredients of the technology "package", including engineering and designing, should become available nationally or at the regional level within a defined period. Some of the more developed Latin American countries, particularly Brazil, Mexico, Chile and Argentina have developed considerable detailed engineering and design capability in various sectors but critical gaps remain even in these countries in, for example, steel, fertilizer and petrochemical branches. In the less developed LA countries, such inadequacy extends to several sectors and nationally-owned consultancy agencies are largely dependent on associated foreign consultancy firms.

13.3. On the whole, a large element of detailed engineering work in these countries continues to remain with foreign engineering and consultancy companies. This is accentuated by a general preference for foreign consultants and engineering firms in projects involving foreign capital participation or technology in the case of "tied" aid and bilateral and even multilateral financial arrangements. The problem of reducing the gap in consultancy, and particularly engineering capability has important policy implications as it is only through a clearly-defined policy regarding the use of national consultancy and engineering services

that such services can develop. Such facilities have developed considerably in some developing countries, such as India, where the use of a national firm is insisted upon as the prime consultant and foreign engineering and other services are only permitted to the extent that these are not domestically available.

13.4. The identification of gaps in technological services has to be done initially on a country-wise basis and for critical and priority sectors, such as chemicals and petrochemicals, fertilizers, basic metals and heavy capital-goods production. This can be done through a joint UNIDO-OAS study, using national institutional agencies in Latin America. Thereafter, gaps in such service capability should be defined for the Latin American region as a whole, again for the same or other priority sectors. The extent to which preferential treatment would be necessary for national and regional engineering consultancy services and would be forthcoming would also need to be assessed and policy norms prescribed regarding the use of national consultants and domestic engineering capability. An aspect also to be analyzed is the nature of technical and financial support, including subsidy, that may be necessary to national consultancy firms undertaking detailed engineering in sophisticated production sectors. The study should also examine the possibilities of setting up a regional engineering consultancy organization in which Latin American countries can participate and which could have sectoral branches in different countries. Such a regional enterprise could receive technical assistance from UNIDO in the initial years. Some efforts at regional collaboration in this regard have been made in the past, but these have not been adequate. At the national level, both UNIDO and OAS (as in the case of ATISA in Mexico) have assisted individual consultancy projects, but this has barely touched a fringe of the problem. A project for the development of engineering capability in African countries is being developed by UNIDO and the Economic Commission for Africa. For the LA region, also unless engineering consultancy at a national or regional level can be developed to a much greater extent, a major infrastructure gap would inevitably remain.

13.5. A related question is that of growth of manpower skills. Most LA countries have made broad assessments of manpower requirements at various technical levels and a number of national training programmes are under implementation. Manpower needs will need to be elaborated in greater detail, particularly at managerial and supervisory levels, in engineering and design activities and at the level of technological decision-making. It will also be necessary to undertake training programmes which are more specialized in particular fields of industry and technological services. Both in terms of coverage and magnitude, training programmes will need to be substantially expanded. A process of "reverse brain drain" should also be developed to enable experienced LA technologists and managerial/supervisory personnel working in developed countries to return to LA countries at least for temporary periods, so that their knowledge and experience can be effectively utilized. Both UNIDO and OAS are assisting a number of training programmes relating to LA countries. The UNIDO's programmes cover in-plant training and specialized training, both within and outside industry, and training of decision-making personnel. The OAS have assistance programmes covering training through fellowships and scholarships in several fields, particularly in scientific and technological research. It would be desirable to exchange information and details regarding the training programmes assisted by both organizations. It would also be desirable to undertake a joint UNIDO/OAS study of training requirements for LA countries in respect of (a) managerial/supervisory personnel in industrial enterprises and technology institutions; (b) engineering and design personnel and (c) decision-makers in the field of industrial and technology policies, and thereafter take up an expanded programme to cover (a) and (b) through in-plant and in-institution training, both in developed countries and in developing countries of other regions, particularly Asia, and through regional workshops in the case of (c).

14. Determination of technology policy framework:

14.1. The need for a policy on Science and Technology has been fairly universally recognized in LA countries and certain broad objectives have been repeatedly stressed at several intergovernmental meetings and seminars. Technology policy, however, cannot be viewed in isolation and has to be conceived in terms of the level of development, factor-endowments and socio-economic aims of each country, though certain common regional objectives and programmes can also be identified. Such a policy has also to be integrated within the over-all economic and industrial policy of a country and a region and several policy instruments have an important bearing on technological progress. A number of such policy instruments play a significant but indirect role. These include national laws and regulations on licensing of industrial production (as in India), defining of new and necessary industries (as in Mexico), controls over foreign equity investment, remittance of dividends and employment of expatriates, incentives for exports (tax refund certificates, direct subsidies, etc.), incentives for import substitution, controls over and tariffs on imports, tax deductions for machinery replacement, capacity expansion, etc., maintenance of quality through standards and quality control, regulations regarding weight and measures and various forms of financial assistance for particular sectors, such as small-scale industries or specific purposes such as feasibility or market studies. A number of policy instruments have, however, a direct role and impact on technological development. These can be considered under (a) institutional instruments and (b) legal and fiscal measures.

14.2. A number of governmental and semi-governmental institutions and agencies are inevitably involved, in view of the vast coverage of technology problems. The principal institutional instruments, however, that have direct impact on technological transfer and change in Latin American countries are (i) Technology Agencies and Institutions, such as the CONACYT in Mexico, the CONICITS in Chile, Venezuela and Costa Rica and Technology/Research Centres and Institutes in other LA countries; (ii) National regulatory

bodies for foreign investment and (iii) National Registries to control and regulate foreign technology inflow in several Latin American countries. In some countries, regulation of foreign investment and technology is done through some other agency or directly by government departments, but functionally the issues remain the same. The role of Technology Agencies and Institutions has already been discussed in para 12 above and it has been suggested that a joint study should be conducted regarding the technological impact of such institutions in LA countries.

14.3. Regulatory agencies for foreign investments have close working relations with the principal government departments and are usually part of the Industries and Finance Ministries in view of the significant policy implications of such investments. The policy on foreign investment constitutes one of the basic policies of most developing countries. Such policies in LA countries are, by and large, following a pattern of state ownership of certain key sectors such as petroleum, electricity and mineral development, while foreign holdings in most other sectors are limited to 49%, though certain exceptions have been and are being made. A policy of permitting 49% foreign holdings has its obvious implications in terms of foreign control and may require further analysis, at least for sectors where mobilization of investible resources does not constitute a major constraint or which are considered as critical growth sectors. Exchange of experience with developing countries of other regions, particularly several Asian countries, should prove useful in delineating certain production and distribution sectors where the extent of foreign holdings in new enterprises may need to be further reviewed. An even more critical issue relates to existing foreign subsidiaries and affiliates which, for historical reasons, have been able to retain their original form, with marginal adjustments and who continue to occupy a pivotal role in their respective sectors. Here again, exchange of experience with developing countries of other regions may prove useful for Latin American countries and vice versa. At the national level, regulatory agencies need to appraise the over-all impact of foreign

subsidiaries and affiliates, in terms not only of outflows of dividends and profits, which is usually done, but of the mobilization of new investments required, the coverage of likely production gaps, contribution to exports performance, the extent of domestic integration in production and other related aspects, which often tend to get glossed over. It is suggested that UNIDO should undertake a comparative study of foreign investment policies of selected developing countries and assess their impact on technological development, particularly policies relating to existing foreign subsidiaries or affiliates, with OAS commissioning a similar study for Latin American countries. Such a study would be very useful in sharing and highlighting international experience on this vital policy issue and its relationship with technological growth.

14.4.1. In respect of regulatory agencies for technology viz the National Registries in several LA countries, a fairly close relationship exists between UNIDO and many of the Registries and considerable expertise and assistance has been provided by UNIDO, both in setting up and developing these institutions. It is, however, necessary now to consider these units in more dynamic terms than merely as regulatory agencies to oversee technology contracts, or to ensure that certain essential functions in this regard are performed by other agencies. Since foreign technology contracting, either for a foreign subsidiary, joint venture or license agreement, will continue to play an increasing role in technology transfer, with growing industrialization in these countries, it is necessary that there should be a critical appraisal of certain other aspects of technology inflow. These should include (a) an analysis of the impact of foreign technology inflow in various sectors in terms of costs and benefits over a period of time; (b) an assessment of the extent of absorption and adaptation achieved in different sectors and types of technology, by national enterprises; (c) determination of sectors and industrial branches in which further inflow of foreign technology would be unnecessary

and repetitive and may be otherwise undesirable, as it may serve as a disincentive to indigenous technological development; (d) definition of areas in which technological inflow is necessary or desirable and the implementation of promotional measures to ensure that such inflow does, in fact, take place; (e) definition of appropriate technologies in fields where technology import is considered necessary; (f) assessment of the impact of unused patents in different sectors; (g) an analysis of technological services imported with process technology in various sectors.

14.4.2. The above list is illustrative only and is intended to highlight the need for continuous review of the implications and impact of foreign technology inflow. It is not necessary, nor would it perhaps be practicable for the National Registries to undertake such comprehensive and continuing analyses for all sectors, the responsibility should be shared between various agencies and institutions dealing with technology. It must, nevertheless, be stressed that Technology Registries and similar bodies must be viewed as dynamic and evolving institutions and should play a critical and continuous role in technological change. It must also be emphasized that very close co-ordination must be ensured between the various regulatory and technology-assessment agencies. Each country has its own set of institutions which can perform one or other of these tasks in relation to particular sectors most effectively, but the role of co-ordination is very important and should normally lie with the agency dealing with technology inflow, as this body would be most directly responsible.

14.4.3. It is considered that an important area of UNIDO/OAS collaboration would be to review and determine the future role of National Registries and other agencies concerned with technological change in Latin America.

14.4.4. An issue of considerable significance in this context is the pooling of knowledge and experience among Latin American countries regarding negotiations and contractual agreements relating to foreign technology,

which are approved or rejected by National Registries. There has been some reluctance to share such information, partly because such contractual information has traditionally been considered to be confidential. Such reluctance may not have either legal or economic validity. Confidentiality needs to be certainly ensured regarding details of technical processes or know-how covered by technology contracts, but the terms of agreement and the process of negotiations should be able to be shared between various regulatory bodies. This would greatly strengthen the bargaining position of the regulatory agencies as also of the recipient enterprises.

14.4.5. The extent and nature of information to be pooled regarding various technology contracts approved/rejected by the various Technology Registries in Latin American countries would be a very useful area for a UNIDO/OAS study.

14.5. An important area for further analysis by UNIDO in collaboration with OAS for LA countries is the determination and analysis of various fiscal and regulatory policy measures which have a direct impact on technology and indigenous R and D. This would cover both negative and positive incentives to reduce dependence on foreign technology on the one hand and actively encourage and promote national R&D, both at institutional and enterprise level, on the other. Fiscal measures would include taxes on foreign royalty payments and foreign consultancy charges, restrictions on royalty remittances beyond certain levels, tax relief on local R&D expenditure and on consultancy services and technology exported from developing countries, while regulatory measures are generally incorporated in fairly comprehensive guidelines for regulatory bodies. The collection of information and experience of several developing countries, including India and the Republic of Korea would be very useful in this context.

15. Identification of sectoral technological requirements:

15.1. Technology planning must be essentially construed as an integral part of over-all developmental planning and strategy for any economy and technological needs must be assessed in the light of over-all economic

and industrial objectives. Such targets have to be broken down to the sectoral level to determine the extent and nature of technological needs and sectoral growth projections necessarily need to be made, particularly for priority growth sectors. Technological needs would obviously vary considerably for countries with widely-divergent industrial programmes. The requirements for an oil-rich economy projecting the rapid growth of the petroleum and petrochemical sectors would be quite different from that of a small island economy concentrating on agro-based middle and small-scale industries. Similar variations in inter-sectoral priorities would exist among most developing countries, depending on several considerations such as the stage of industrial growth, factor-endowments, resource availability, socio-economic policies and the like. Technological requirements have necessarily to be related to the macro requirements of the economy over a period of time and must consequently be viewed in the light of specific sectoral needs constituting the macro development programme.

15.2. While the basic elements of technological infrastructure would remain the same, these would vary considerably in details, depending on inter-sectoral priorities over given periods of time. The struction of technological information services would, for example, have to be directly geared to defined sectoral needs with technology suppliers and the pattern of technological absorption and adaptation. Technology Institutions would particularly need to be oriented to broad sectoral priorities, so as to ensure maximum impact and effect. The development of technological services such as consultancy, engineering and designs and the development of industrial services such as testing, metrology, standardization, quality control has to be directly related to identified sectoral requirements, so that these can be developed in close conjunction with such needs, both at the macro and enterprise levels.

15.3. Technological needs in terms of specific manufacturing or process technology would also vary considerably, depending on sectoral industrial programmes and priorities. Sugar-producing nations of Latin America appropriately emphasize the technological aspects of utilization

of bye-products of this industry. Agro- and food industries also need specific technological emphasis in most LA countries. The larger countries, which already possess a fairly diversified industrial base need to extend coverage over a wider area of technological infrastructure, services and R&D. Similarly, any regional technology plan has also to be related to sectoral programmes and priorities in the region as a whole.

15.4. The determination of sectoral technological needs does not necessarily require a detailed sectoral planning exercise at the national and regional levels. To the extent that such an exercise is done, technological needs in terms of infrastructure, services and technology to be acquired, and all the aspects associated with acquisition, can be defined more specifically. Even, however, on the basis of fairly broad priorities, which is available in most LA countries, in varying degrees, it should be possible to identify technological requirements, both in terms of infrastructure and process or production techniques.

15.5. It is against this background that the UNIDO/OAS role should be considered regarding the assessment of sectoral technological needs. The OAS studies, including the PPTT, have already examined technological needs at the enterprise level for several sectors in a number of LA countries. This is a valuable input in itself. At the same time, it is necessary to identify the priority growth sectors, both from national and regional viewpoints, in LA countries. Sectoral emphasis in the OAS studies at present has been principally in respect of (i) food industries, including food preservation and marketing; (ii) basic metals, including metal transformation; and (iii) chemical industries, including synthetic resins and plastics and petroleum and coal derivates. The OAS may consider whether this sectoral list should be expanded and elaborated.

The sectoral studies undertaken by UNIDO in Latin America have a wider base and a number of such studies have been made in several LA countries. The Economic Commission for Latin America (ECLA) has also completed a number of sectoral studies for individual LA countries and groups of such countries, such as

Central America. It would be desirable for UNIDO, with the assistance of ECLA and national governments to collate information regarding the sectoral studies already undertaken and to outline a programme of sectoral growth priorities for the Latin American region for the period 1980-5. This could then be further considered by national governments or at a regional level. Thereafter, a technology development programme could be outlined to cover the identified requirements for an approved programme of sectoral priorities.

15.6. The UNIDO has undertaken in-depth studies of several industrial sectors which would be of special significance to developing countries. Such analysis would cover projections of internal and external demands, magnitude and implications of new investments, assessment and evaluation of alternative technologies and other relevant industrial information. Initially, the sectors selected are:

(a) agro-industries and agricultural machinery;
(b) chemicals and petrochemicals;
(c) pharmaceuticals;
(d) oils and fats;
(e) metal-working and metal transformation;
(f) wood-working;
(g) leather;
(h) building materials.

Besides, for the two major production sectors viz iron and steel and fertilizers, in-depth studies have already made significant progress and have been accompanied by international consultations between developing and developed nations. The in-depth studies would cover the principal technological problems and implications in respect of each sector while the system of consultations is designed to ensure that detailed meetings and discussions can take place with potential investors and technology suppliers with a view to cover both production and technology gaps in the developing countries. The results of these studies could usefully be brought to the attention of LA countries.

To the extent that the OAS may be interested in undertaking case studies in these sectors in LA countries, the organization could be specifically associated, so that experience in methodology and approach could be shared and developed.

15.7. Sectoral technological demand also needs to be identified at regional level. The Latin American region particularly lends itself to such an approach for a number of major industrial sectors, such as fertilizers, petrochemicals, capital-goods production and the like. Such identification could constitute a pre-requisite for collective bargaining in technology for the region as a whole, which is also a concept being developed in UNIDO. Such collective bargaining could have a very significant impact on the bargaining capacities of these countries and consequently on the cost and terms of technology acquisition.

16. Role of international agencies, particularly UNIDO, in growth of S/T at institutional level:

16.1. A number of international and inter-regional organizations are increasingly involved in different aspects of scientific and technological growth. Technology as a concept and in its relation to science, has a very wide connotation and can be extended to most productive branches and social services, including agriculture, health, education, housing, transportation, mass media, etc. besides the techniques of production and manufacture in industry, with which this study is solely concerned. At the UN institutional level, the broader aspects of education and science, including their co-relation with technology, are dealt with by UNESCO while technological aspects of branches such as agriculture, health, labour and industry are covered by international agencies such as FAO, WHO, ILO and UNIDO. Besides, a very large number of studies on technology, in its general and applied aspects, have been made by several academic and other institutions. With the close interlinkage between science and technology in most fields, it is difficult to draw a hard and fast line in the role of a plethora of agencies and institutions dealing with one or other aspect of technology as applied to industry

and a considerable degree of overlapping appears inevitable. From this viewpoint of developing countries, it is necessary, however, to ensure a close degree of co-ordination so that a basic conceptual approach can be identified and agreed upon.

16.2. It is axiomatic that UNIDO, as the international agency responsible for industrial development, must play a dynamic role in the growth of ST related to the manufacturing sector. Such a role must be visualized in fairly comprehensive terms in order to identify the institutional links that have to be established and developed. These can broadly be classified under the following heads:(a) technology policies; (b) identification of technological needs; (c) development of technological infrastructure, particularly technological services; (d) development of manpower resources; (e) collection, classification and dissemination of technological information, including alternative technologies; (f) evaluation, selection and acquisition of appropriate technology, including negotiations relating to investment, licensing and technological services; (g) development of R+D through absorption and adaptation;and (h) development of innovations and new technologies in fields of particular interest to developing countries. Most of these aspects have been briefly touched upon in this paper and it would suffice to pinpoint only certain essential features and institutional interlinkages.

16.3. Technology policy: In several developing countries, plans for ST development are either under preparation or have been incorporated into formal documents. Thus, Brazil initiated a two-year Plan in 1973-4 (Plan Basico de Desarrollo Cientifico y Tecnológico - PBDCT)which was followed by a Second Plan for the period 1975-9. A National Fund for Scientific and Technological Development has also been set up in Brazil for financing studies and projects (Financiadora de Estudios y Proyectos - FINEP). Mexico also drew up a fairly comprehensive ST Plan. In India, a detailed ST plan covering the principal growth sectors, and outlining the principal

research and development programmes in each sector, has been finalized and published. In various other developing countries also, such ST plans are in various stages of formulation or finalization. During this stage of planning and programming of ST policies in most developing countries, it is necessary to define the essential ingredients of such a policy, which would also encompass most of the other aspects. These ingredients should, inter alia, include (a) assessment of the existing stage of development in industry, including the pattern of ownership and control, dependance on foreign technology, degree of absorption, identification of sectors in which adequate inflow of foreign techniques has taken place, degree of R+D at enterprise level, etc.; (b) relationship with other economic and industrial policies such as policies on new existing holdings, import substitution, export incentives, etc., (c) relationships between planning organizations and Ministries and Departments of Government on the one hand and the agency or agencies responsible for technological development on the other; and (d) identification of technological needs and institutional and policy measures to meet such requirements. The UNIDO should undertake a study to define the various ingredients of a comprehensive technology policy in developing countries.

16.4. Identification of technology needs: The institutional agencies which should be closely associated with such determination, apart from the Department/Agency directly responsible should be identified, both at macro and micro level, as their participation would be an essential pre-requisite for a comprehensive ST Plan. At macro level these would normally be the planning agencies where detailed planning exercises have been done or Ministries of Industries or Commerce or Departments/Agencies responsible for particular sectors. At the enterprise level, technology institutions, chambers of commerce or industry concerned or centres of information and research need to be associated and, if necessary, developed for this purpose. The task would be not only to review the various ST programmes and activities in terms of research projects at various levels and for

various sectors but to identify areas where foreign technology inputs are necessary and to consider appropriate mechanisms for both these purposes and to ensure adequate information flow at different stages.

16.5. Technological infrastructure: An institutional network for assessing gaps in technological infrastructure should be identified for developing countries at various stages of development. Guidelines should also be prescribed for classification of technical services nationally available and assessment of their capacity and suitability. The mechanism of identification and coverage of gaps in consultancy services, particularly, engineering and design capability and of industrial services such as standards, quality control, etc. should be defined.

16.6. Manpower resources: A framework for appropriate manpower planning for industrial needs should be set out, together with suitable institutional mechanisms to develop adequate capability in identified areas of specialization within a defined time span.

16.7. Technological information: An appropriate mechanism or mechanisms for setting up adequate information network at national and regional level at various developmental stages should be drawn up, which can be adapted to specific national needs at different points of time. Such a network should cover collection, classification, dissemination and follow-up of relevant industrial information, so as to serve as an effective data bank for industrial and technology planning at both macro and micro levels. An essential feature should be to provide necessary information and details regarding alternative technologies and techniques to cover identified technological needs.

16.8. Evaluation, selection and acquisition of technology: An appropriate institutional framework and mechanisms for evaluating and assisting the acquisition of required technology should be drawn up, for adaptation in accordance with national needs. This institutional role should be considered as distinct from the regulatory functions exercised by National

Registries in LA countries, though such institutions could also partially be utilized in such role. The process of acquisition should include evaluation methodology, including cost-benefit and cost-effectiveness analysis for different sectors and types of technology, the determination of appropriate technology, the disaggregation of the technology "package" particularly for major projects, the process of negotiations, including investment participation by technology suppliers and details of technology and services supplied, together with guidelines prescribed for regulatory agencies and the detailed terms and conditions of technology contracts. The linkage between such institutional mechanisms at national level and the Industrial and Technological Information Bank in UNIDO should be identified. It would be desirable for UNIDO to undertake a specific study to define the institutional role and responsibilities in this regard.

16.9. Development of R&D through absorption and adaptation: The appropriate institutional framework to undertake such assessment and to assist the process of absorption and adaptation should be defined, together with certain basic aspects such as (a) functions and powers that such institutions should be given for obtaining relevant information; (b) flow of problems from the industrial sector to such units; and (c) the nature of technical expertise and assistance that needs to be provided for by such institutions. While a number of technology institutions have been set up in Latin America and other developing countries, their specific role vis-à-vis national enterprises, through whom such absorption and adaptation largely takes place, is often not clearly formulated and defined. The policy aspects of enterprise-level R&D activities, including tax relief and incentives, should also be analyzed and highlighted.

16.10. Development of new technologies: In certain sectors of particular interest to several developing countries, such as integrated rural industries or small-scale industries in tropical regions, a new approach to technological development and new technical processes and techniques may need to be evolved. Similarly, in the energy sector, which is critical for most countries, various technological possibilities have to be considered afresh and

an effective lead should be given by international agencies, such as UNIDO, both in identifying such sectors and defining the appropriate institutional mechanism that could undertake such R+D activities. Programme of direct assistance for such R+D activities in developing countries should be an integral part of technology-development programmes of UNIDO, including the setting up of R+D centres in developing countries in fields such as non-conventional energy.

16.11. The above role outlined for international agencies, particularly UNIDO, in fostering institutional planning and development of science and technology as applied to industry and the manufacturing sector could be usefully complemented by regional organizations, such as the OAS, which should take up a similar role and programme for LA countries.

17. Creation of a Fund for Development of Industrial Technology

17.1. The fairly comprehensive role outlined in para 16 above in respect of institutional development of technology in developing countries necessitates consideration of resource availability for such a programme. Resources have undoubtedly been allocated in UNIDO's programme of activities for one or other of these functions but a more comprehensive approach will inevitably require a substantially-higher resource outlay.

17.2. It is accordingly recommended that a separate Fund for Development of Industrial Technology should be created in UNIDO for financing the institutional programmes relating to ST development. This would ensure an integrated approach to this basic question in place of a large number of individual schemes being assisted at present. The Fund's activities would be complementary to that of INTIB and its financing role and functions would, inter alia, cover (i) development of a technology policy framework related to the manufacturing sector in developing countries; (ii) identification of technological needs at various developmental stages, including technological infrastructure; (iii) development of technological service capability, including engineering and designs and industrial services, including training programmes to cover manpower needs at specialized levels; (iv) development

of information mechanisms, including technological alternatives; (v) development of mechanisms for evaluation, selection and acquisition of appropriate technology; (vi) developing appropriate mechanisms for programming R and D activities through effective absorption and adaptation of foreign technology; and (vii) developing mechanisms for undertaking R and D activities in relatively new fields of particular interest to developing countries or regions. The institutional R and D activities would be carried out in appropriate technology institutions in developing countries, but the approach, the structural mechanism, the data and processing arrangements would be defined and assistance provided to institutions in developing countries to achieve these objectives through the activity-programme financed by such a Fund.

17.3. Since a decision has been taken to set up a UN Industrial Development Fund (UNIDF), the proposed Fund for Development of Industrial Technology could be a part of UNIDF or be treated as a Sub-Fund within the UNIDF for the specific purposes and objectives indicated above.

18. Technological co-operation among developing countries

18.1. An essential aspect of technological growth is the need for closer co-operation and co-ordination between developing countries. It is increasingly being felt in developing countries that they cannot rely solely on the goodwill and participation of industrialized nations and enterprises and institutions from these countries. To the extent that effective technological exchange and inflow can take place through acceptable investment programmes and foreign affiliates, joint ventures and licensing and other arrangements with such institutions and enterprises, these should be encouraged and developed and an appropriate policy framework and infrastructure must be created. At the same time, closer co-operation can and must take place between developing countries to a

much greater extent. Such co-operation can take various forms, besides direct technology inflow through joint ventures or licensing arrangements between enterprises in developing countries.

18.2. The various forms of co-operation, apart from direct technology inflow, can relate to (i) collective action and approach on contractual provisions in technology agreements; (ii) exchange of information regarding technology contracts, including negotiations and working of such contracts; (iii) joint selection of appropriate technology and know-how in selected sectors; (iv) collective bargaining for technology licensing and know-how by groups of developing countries; (v) collective action in respect of revisions in patent and trademark legislation; (vi) development of a technology pool in selected sectors; (vii) joint R and D activities in selected branches; (viii) joint training programmes for certain specialized categories of personnel, and the like.

18.3. Direct technology flow can also take place fairly extensively at present in view of adequate technological development in several sectors in various developing countries. It is important, however, that the principles governing such inflow and exchange should be carefully defined and a new set of"rules of the game" prescribed. Developing countries achieving adequate technological progress in one or other sector must be prepared to share such technology on a different basis than enterprises from developed countries, so that new standards and principles can be laid down and adopted in respect of international technological exchange.

18.4. It would be desirable for UNIDO to examine the detailed nature and possibilities of joint and co-operative action by developing countries on various aspects of industrial technological development and to prescribe a new set of principles and standards in respect of direct technological inflow between enterprises in developing countries. The OAS should consider a similar programme for Latin American countries.

APPENDIX I

List of persons in OAS with whom meetings were held in Washington

1.	Mr. Otto H. Salzmann	-	Director, Liaison Services/Office of the Secretary General
2.	Mr. Edward P. Davis	-	Chief, Unit of Co-operation with Industrial Organizations
3.	Mr. Michael P. Greene	-	Deputy Director, Department of Scientific Affairs (Departamento de Asuntos Científicos)
4.	Mr. Carlos Martinez-Vidal	-	Acting Chief, Technical Unit on Technological Development (Unidad Técnica de Desarrollo Tecnológico)
5.	Mr. Erwin E. Fetzer	-	Chief, Technical Unit on Technical Change and Transfer of Technology (Unidad de Politica y Planificación de Cambio Tecnico y Transferencia de Tecnología)
6.	Mr. German Framinan	-	Unit on Scientific and Technological Policy and Planning (Unidad de Politica y Planificación Cientifica y Tecnologica)
7.	Mr. Zoltan Szabo	-	Senior Economist, Industrial Development Programme (Programa de Desarrollo Industrial)

APPENDIX II

Major programmes and projects (where OAS contribution exceeded US$ 50,000) undertaken by OAS for scientific and technological development in industrial and manufacturing sectors in Latin America

Programme or Project	Country	Institution	Period of Operation
1. Utilización Energia Solar	Argentina	Comite Nacional de Estudios Geoheliofisicos (CNECH)	1975-7
2. Tecnología de la Lana	Argentina	Centro de Investigaciones Textiles del INTI	1974-7
3. Metrología	Argentina	Departamento de Física del INTI	1975-7
4. Subprod. de la Caña de Azucar	Barbados	Ministry of Agriculture, Science and Technology	1974-6
5. Información y Asistencia Técnica Industrial	Bolivia	Dirección General de Normas y Tecnologías	1974-6
6. Técnica de Alimentos	Brasil	Instituto de Tec. de Alimentos	1974-7
7. Utilización de Energía Solar	Brasil	FINEP	1975-7
8. Tec. de Computación Electronica	Brasil	U. Fed. de Rio de Janeiro	1974-7
9. Coquización y Gasificación de Carbones	Chile	Instituto de Investicación Técnica INTEC/CORFO	1974-7
10. Información y Asistencia Técnica a la Industria	Chile	CONICYT	1974-7
11. - " -	Chile	CORFO	1974-7

Programme or Project	Country	Institution	Period of Operation
12. Coquización y Gasificación de Carbones	Columbia	Instituto de Investigación Técnica	1974-7
13. Información y Asistencia Técnica a la Industria	Columbia	Colciencias	1974-7
14. - " -	Columbia	ITT	1974-7
15. Valores Biofarmaceuticas	Costa Rica	Fac. de Farmacia U. de Costa Rica	1974-7
16. Información y Asistencia Técnica a la Industria	Costa Rica	CONICIT	1975-7 (US$ 40,000 so far)
17. Técnica de Alimentos	Ecuador	Instituto de Inves. Tec. de la U. Tec. de Ambato	1975-7
18. Polimerización de olefinas	Ecuador	Esc. Política Nacional	1974-7
19. Metrologia	Ecuador	Instituto Ecuatoriano de Normalización	1975-7
20. Información y Asistencia Técnica a la Industria	Guatemala	Inst. Tec. de Capacitación y Productividad	1975-7
21. Subproductos de la Caña de Azucar	Haiti	Inst. des. Agriculo	1-74-7
22. Información y Asistencia Ténica a la Industria	Honduras	Banco Central de Honduras Depto. de Inv. Ind.	1975-7
23. Subproductos de Caña de Azucar	Jamaica	Sugar Industry Authority	1974-7
24. Coquización y Gasificación de Carbones	Mexico	Instituto Mexicano de Inv. Siderúrgicas IMIS)	1974-6

Program or Project	Country	Institution	Period of Operation
25. Subproductos de la Cana de Azucar	Mexico	Instituto de Investigaciónes Biomedicas	1974-7
26. Técnica de Alimentos	Mexico	en tres institutos y centros	1974-7
27. Utilización de Energía Solar	Mexico	Centro de Investigaciones Avanzadas	1974-7
28. Técnica de la Computación Electronica	Mexico	- " -	1974-7
29. Información y Asistencia Técnica a la Industria	Mexico	CONACYT y INFOTEC	1974-7
30. Inves. de Rec. Marinos	Mexico	Centro de Ciencia del Mar. UNAM	1975-7
		Centro de Investigación de Ensenada	1975-7
31. Metrología	Mexico	Centro de Inv. y Estudios Avanzados y CICESE	1975-7
32. Maquinaría y Equipo	Mexico	CONACYT y Aso. Tec. Ind. SA de CV (ATISA)	1975-7
33. Información y Asistencia Técnica a la Industria	Nicaragua	Banco Central	1975-7
34. Metrología	Panama	COPANIT	1975-7
35. Información y Asistencia Técnica a la Industria	Peru	5 unidades	1974-7
36. Subproductos de la Cana de Azucar	República Dominicana	CEACANA	1974-6
37. Utilización de Energía Solar	Trinidad y Tobago	UW I	1974-7

Programme or Project	Country	Institution	Period of Operation
38. Esquistos Bituminosos	Uruguay	Adm. Nac. de Combustibles	1974-7
39. Metrología	Uruguay	Instituto de Inv. Ciencas. Biologicas	1974-6
40. Gasificación y Coquización de Carbones	Venezuela	U. Metropolitane	1974-7
41. Fac. de Alimentos	Venezuela	U. Central de Venezuela	1974-7
42. Polimerización de olefinas	Venezuela	U. Central	1974-7
43. Información y Asistencia Técnica a la Industria	Venezuela	CONICIT	1974-7

Regional Programme of Science/Technology Development

(Programa Regional de Desarrollo Cientifico y Tecnologico)

- OAS Assistance above US$ 50,000

A number of projects (over 110) and studies have been sanctioned by OAS under this programme with assistance ranging up to US$ 50,000. Projects and studies assisted financially to the extent of US$ 50,000 and above are listed below:

1. Multinacional de Metal Extractiva y de Transformación	Brazil	COPPE, U. Fed. y Inst. Militar de Ing.
2. Organización de Programas y Proyectos	Brazil	Consejo Nacional de Desarrollo Científico y Técnico, Rio de Janeiro
3. Multinacional de Ciencias agro pecuarias	Brazil	Centro de C.y.T. U. de Paraiba
4. Tecnología de Alimentos	Mexico	U. de Aueretero y U. de Guadalgera Politecnico Nacional
5. Metalurgía	Mexico	Con. de Instituto Mexicano, CONACYT U. de San Luis Potosi

APPENDIX III

Specific studies on various aspects of technology transfer undertaken by OAS:

A) General studies relating to technology policies and implications */

1. Machinery Supplies and the Transfer of Technology in Latin America by Charles Cooper and Philip Maxwell, SPRU, Sussex University (OAS 1975), PPTT-14,

2. Local Participation in Major Public Works Projects, by Oscar Wortman and Luis Darnond (OAS 1975) - PPTT-15;

3. Current Status of Registers on Transfer of Technology in Latin America, by Juan Manuel Ugarte (OAS 1975) - PPTT-18;

4. Selection of Industrial Sectors, by John Wilkes - PPTT-8;

5. Guidelines to Formulating Technology Requirements for Use in Technical Information Dissemination Systems - Vol. III (OAS) - PPTT-7(c);

6. Methods of Technological Assessment - Methods of Evaluation of Technology, by Ternier Buchot P.F., Vol. II (OAS) - PPTT-7(b);

7. Summary of Ideas presented in the Symposium on Transfer of Technology by Franco Vidossich - Vol. III (OAS) - PPTT-7 (e);

8. Technology of Scale-Methods of Evaluation of Technology, by Mario Kamenetsky - Vl II (OAS) PPTT-7 (c);

9. Application of Social Cost-Benefit Analysis for Choosing Among Alternative Technologies by Kenneth J. Ruffing - ILPES(UN), Vol. II -PPTT-7(c

10. Informe Sobre la Evaluación, Estado Actual y Posibles Lineas de Acción Futura en el Campo del Desarrollo Tecnológico en América Latina y el Caribe.

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*/ Most of the studies are in Spanish

B) Studies relating to particular sectors:

1. Opening the Technological Package for the Atucha (Argentina) Nuclear Power Plant -- Methods of evaluation of technology, Vol. IV, by Jorge Sabato and Oscar Wortman - PPTT-7 (d);

2. Direct Reduction of Iron Minerals and Its Application in Latin America, by Fernando Aguirre Tupper and René Barbis - PPTT-12;

3. Methodological Scheme for Documentation of Concrete Cases involved in Transfer, Adaptation and Development of Appropriate Chemical Technology; by José Giral, seminar document, Quito, 1975 - PPTT-11

4. Negotiations and Exploitation of Foreign Technology, the case of the chemical and petrochemical industries, by Francisco Sercovitch; (OAS 1975 - PPTT-17;

5. Analysis of Cases of Technology Contract Negotiation, by Roberto Brezzo, (OAS 1975)- PPTT-31;

6. Negociación de Tecnologías Para el Sector Químico y Petroquímico, presentatción de resultados, por Regulo Sardi;

7. Manual Para Desarrollo, Transferencia y Adaptación de Tecnología Química Apropiada, por José Giral;

8. Ensayo de Regimen de Tecnología, el caso de la fundición ferrosa, por Jorge Sabato, Rogne Carranza y Gerardo Garguilo - punto focal naoional - Argentina

APPENDIX IV

	Implementation	Liaison	Question and Answer	Search	Selective Dissemination of Information	Information Systems for Management
BOLIVIA						
Dirección General de Normas y Tecnología		x	x	x		
COLOMBIA						
Colciencias			x	x		
Instituto de Investigaciones Tecnológicas		x	x	x	x	
COSTA RICA						
Conicit				x		
CHILE						
Conicit			x	x	x	
Instituto de Invest. Tec.		x	x	x	x	x
ECUADOR						
Centro de Desarr. Indus. del Ecuador		x	x	x	x	x
Instit. de Invest. de Tec. nología/Escuela Politéc. Nacional			x	x		
EL SALVADOR						
Centro Ncl. de Product.		x	x	x		
GUATEMALA						
Inst. téc. de capacitac. y productividad		x	x	x		
Inst. centro americano de invest. tecnolo. indus.			x	x		
HAITI						
Inst. de Developp. Agric. et Industriel	x					
HONDURAS						
Universidad Ncl. autóno. de Honduras			x	x		
Banco Central de Honduras			x	x		
JAMAICA						
Scientific Research Council				x		

	Implementation Liaison	Question and Answer	Search	Selective Dissemination of Information	Information System for Management
MEXICO					
Conacyt			x	x	
Infotec	x	x	x	x	x
NICARAGUA					
Bco. Central	x	x	x		
PARAGUAY					
Inst. Nc. de Tecnología y Normalización					
PERU					
Consejo Ncl. de Invest.			x	x	
Induperu		x	x	x	
Electroperu			x		
Petroperu		x	x	x	
Mineroperu			x		
Pescaperu			x		
DOMINICAN REP.					
Inst. Dominicano de Tecnología			x		
TRINIDAD AND TOBAGO					
Caribbean Indus. Resear. Institute		x	x		
VENEZUELA					
Conicit		x	x	x	

IV. FUTURE ACTION

As stated in the preceding pages, any efforts made in the area of technical information will have no impact on the promotion of technical change unless they are linked to coordinated work in other related areas.

In Latin America, one of the most important sources of technology should be the technological research institutes, since the business sector undertakes little research. For this reason, the information services should be effective vehicles for publicizing the work of these institutes. The proper balance between the work of the institutes and the needs of business leads us to the consideration of the problem of the administration of research and development, which obviously includes the instruments, such as information and publication, which assist in the development of the institution.

Until these three elements are consolidated into a coherent program, we believe that the diffusion of technical change cannot go forward at a more rapid pace.

Through its regular and special projects, the OAS has been active in the implementation of information services only in the last two years.

It can take six years from the organization stage to a stage of relative maturity. We believe that the prime concern should be to complete the development cycle, so that support will not be withdrawn from a service at a vital stage in its growth.

Similarly, it is advisable to attack the problem of the training of human resources on a scale large enough to constitute a real acceleration in the development of the services. This can be done by using modern

where such systems are justified. Similarly, it will be necessary to persuade businesses of the need for the IGM, by making visits, holding consultations, and so forth.

e. Liaison with other purveyors of technological knowledge.

Actions designed to establish greater contacts on the national and regional levels between the SIATE's and the consulting and engineering firms.

f. Liaison with other mechanisms for the development of technology markets.

Actions to make the SIATE's into one of the moving forces in the commercialization of technology, and to make them technical consultants in the acquisition by businesses of that technology.

g. Design of mechanisms for the diffusion of technology to marginal sectors.

Actions that will provide access to the sources of technology by the production sectors that are marginal, by reason of their geographical location, or of the socio-economic and cultural conditions of the environment in which they operate.

methods of educational technology, and a program could be designed for this purpose, with the cooperation of institutions having sufficient experience in the field.

The actions that could be begun, or reinforced over the medium term can be broken down into the following components:

a. National Scientific and Technological Information Systems, through technical assistance to the planning agencies responsible.

b. Technical Information Subsystems, through assistance in setting up SIATE's in sectors other than the industrial sector, for example:

- rural technology
- agro-industries
- housing
- energy

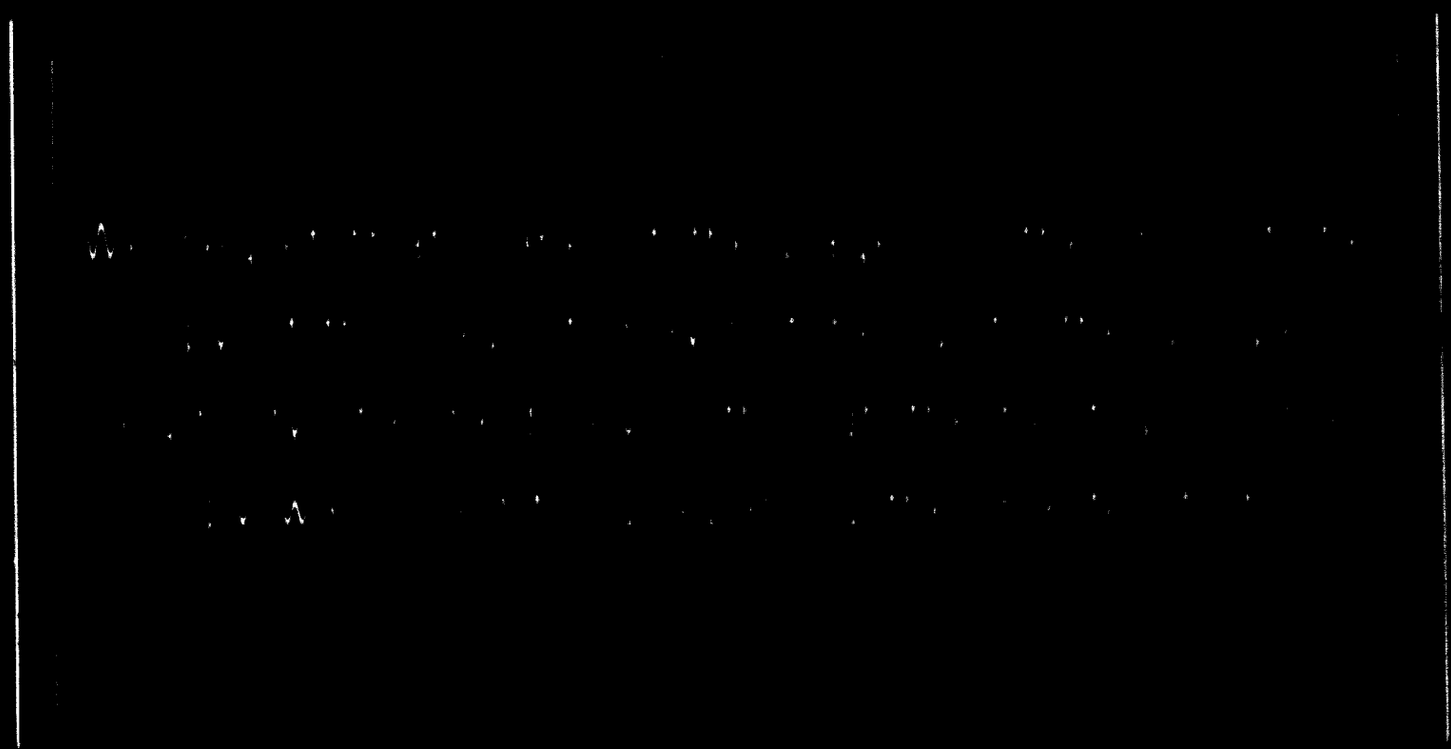
c. Mechanisms for regional cooperation:

Actions designed basically to lay the foundations for a Latin American network for technological information, on the one hand, and on the other, specific agreements for mutual exchange by the public sector, such as, for example: electricity, petroleum, mines, fisheries, in which we find state enterprises playing a dominant role, and possessing valuable information which can be shared.

d. Supporting mechanisms:

Information Systems for Management.

To assist the SIATE's, so that they are in a position to offer advisory services in the setting up of ISM in businesses



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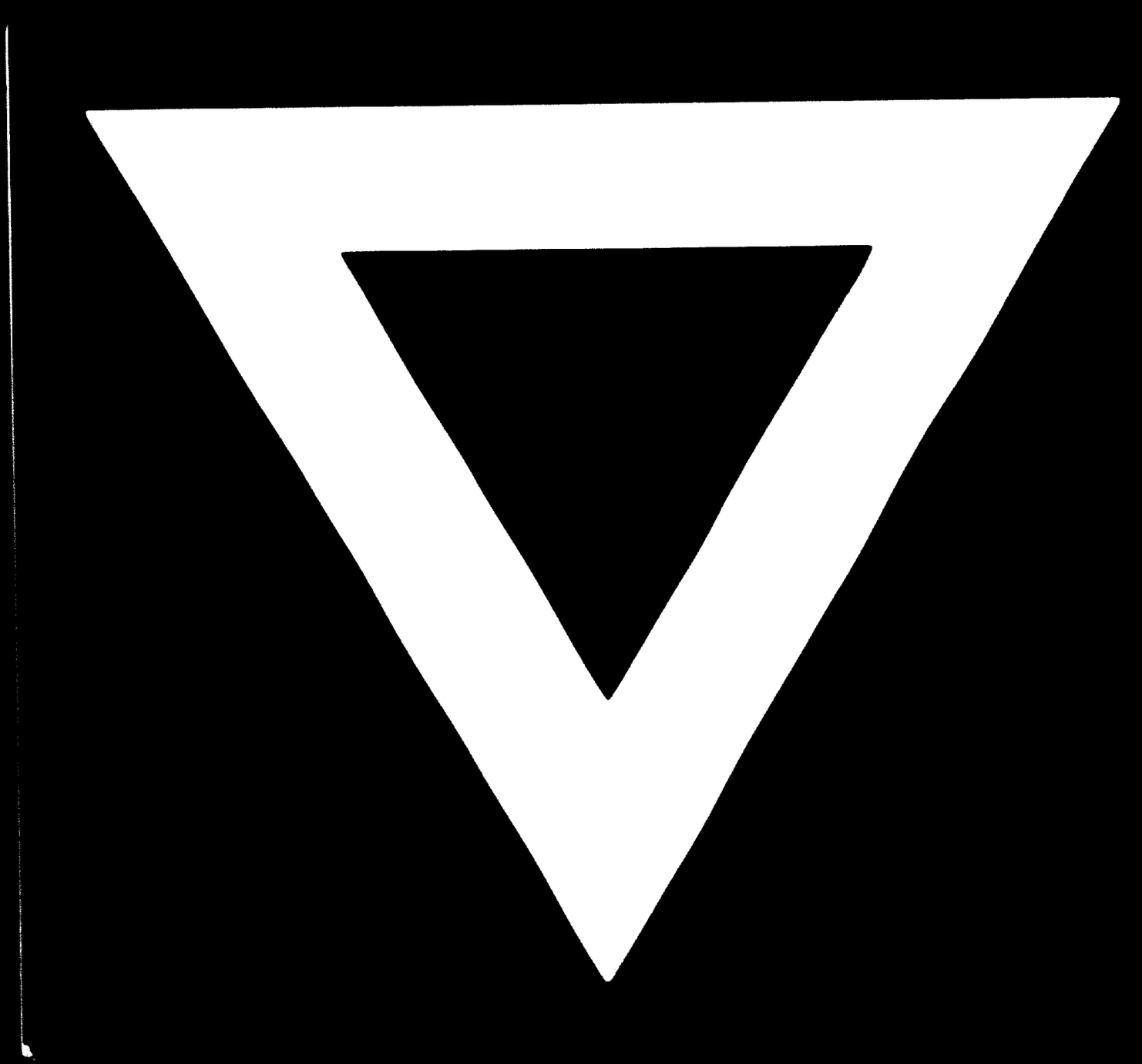

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