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CONSTRAINTS OF THE INTERNATIONAL FLOW OF INFORMATION: THE CASE OF LATIN AMERICAN SCIENTIFIC AND TECHNOLOGICAL INFORMATION

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Paper presented at the 35th Annual Meeting of the American Association for Science Information (ASIS)

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I. A New Development: The decision to create systems for scientific and technological information in Latin America

For 3 years the Organization of American States (OAS) has been active in the field of scientific and technological information for the Latin American countries. Such activities have been facilitated through special assistance provided by the United States government which has enabled the organization to implement an information system training program for "policy makers" and Latin American specialists.

This policy reflects awareness of the need to create scientific and technological information systems at the national and regional levels.

As evidence of this development, the Specialized Conference on the Application of Science and Technology to Latin American Development (CACTAL) (1) formulated specific recommendations for the creation or development of "dynamic information mechanisms designed in accordance with the needs of users". Actually, in Latin America, only Argentina and Brazil possess the necessary elements for a national scientific and technological information system, although it cannot be said that an organized system has been established. In all the other countries--allowing for differences in their respective levels of development--such a system still remains to be established. The new development is that most of the

(1) May 12-19, 1972, Brasilia, Brazil.

Latin American countries are now more clearly aware of this need and intend to meet it. Therefore, an enormous opportunity with great possibilities has been opened to organizers and specialists in the information field.

II. Guidelines to be followed in technical assistance for establishing scientific and technological information systems

Although OAS experience in this field is new and prudence is advisable in reaching conclusions, nevertheless such experience has been sufficient for confidently presenting certain specific and very important points. It appears evident that foreign assistance must observe certain guidelines in Latin America, if it is to be successful.

In brief, it appears that there are three major information areas deserving careful consideration: 1) Analysis of demand for information should be balanced against analysis of its supply; 2) Alternatives should be provided regarding the structure of the scientific and technological information system; and 3) The scientific and technological information system should focus on priority of demand.

A brief comment on them is in order.

1. Increased Attention to Analysis of Demand for Information and Existing Supply Channels

Often experts from industrialized countries act without detailed knowledge of the existing situation. Knowledge of the situation

in the field of scientific and technological information does not entail merely identification of the institutional structure, libraries and documents centers, but also requires understanding of the relationship between sources and users of information.

Lacking sufficient knowledge of the needs of users and of the facilities for transmitting information, foreign experts, who usually have only limited time at their disposal, naturally tend to orient their proposals from the sole standpoint which provides them with solid footing: organization of the supply of information. This explains the vast number of projects not analyzed in sufficient depth in relation to demand which, in greater or lesser measure, are merely transfers of solutions that are familiar and valid within other contexts, but cannot be adapted to the special conditions that prevail in the various Latin American countries.

Consequently, the Organization of American States has sought to correct the imbalance by encouraging the Latin American National Scientific and Technological Research Councils to carry out a balanced analysis of demand and supply for information and has made available to such entities adequate methodological instruments. This has been the basis of the "prediagnoses" carried

out in Argentina, Brazil, Colombia, Chile, Peru, Uruguay and Venezuela. (1)

Subsequently, on the basis of a more sophisticated model prepared by A. H. Rubenstein at Northwestern University (2), which was tested and adapted, an analysis of relations between information sources and users has been carried out in Argentina in the plastics, electronics, meat-packing and iron and steel industries; in Brazil in textiles, plastics and construction materials industries; and in Colombia in overall industrial activities by region. These analyses have made for better understanding of certain essential phenomena, such as the almost total divorce between the national scientific and technological infrastructure and the productive sector, even in the relatively most highly developed countries. This infrastructure is rarely mentioned as a source of information for enterprises. Most of the information obtained in the productive sector on equipment and technical procedures originates in foreign enterprises or groups of consultants. As

(1) OAS: "Mission for Evaluation of Systems for Diffusion of Technological Information in Uruguay, Argentina, Chile, Peru, Brazil, Venezuela, Colombia and Mexico", Washington, D. C., 1971.

(2) RUBENSTEIN, A. H., DAVIG, W. A., JEDLICKA, A. D., and OGLIASTRI, E., "Study of Technology Diffusion in Latin America: Methodology Phase". Northwestern University/OAS, December, 1970.

the national scientific infrastructure is not connected with this channel, there is no screening of information for purposes of comparing, evaluating and selecting alternative technologies. Decisions to import technology on the basis of such limited information leads to guesswork in relation to technological development and, consequently, to development devoid of sufficient consideration of real needs and availabilities of local production factors. On the other hand, information on markets, financing and administrative improvements appears to originate mainly from relations among national enterprises.

Findings of the study on relations between sources and users of information confirm certain conclusions of T. Allen, of MIT relative to users other than enterprises. (1) Information obtained by word of mouth appears to be important. The "most useful" information is divided equally between that which is written and that which is verbal. Recourse to verbal information increases in direct proportion to growth of the enterprise in question. This finding coincides with the conclusion that recourse to verbal sources is related to improved communications networks in the enterprises and, consequently, to more advanced development.

(1) T. J. Allen: "Managing the Flow of Scientific and Technological Information", MIT, September 1966.

It is interesting to note that "fairs and exhibitions" are considered to be among the most important sources of technical information.

As stated previously, information from foreign sources plays a preponderant role, although access to such information is rather difficult. For example, in Argentina, in industries with the most advanced technology (such as the electronics industry) difficulties in obtaining technological information result from two factors: the first is that it is not possible to obtain information from the source without purchasing the product that is manufactured or distributed. The second is that the information obtained is not commensurate with the volume of production sold on the local market. The most serious barriers to technology transfer appear to be economic: the size of the market and the cost of innovations.

In the case of demand for information among research scientists, apparently the problems are not very different from those found in scientific communities of industrialized countries. (1)

(1) Jacques Danon, Disseminação da informação científica em uma comunidade de físicos, FID/CLA, Rio de Janeiro, 1969.

On the other hand, a study currently being carried out in Colombia by J. Jaramillo in scientific circles and among leaders in technological development policy, reveals a significant phenomenon: use of personal libraries as a major source of information, while it appears that interpersonal work relationships constitute the principal source of information. If such is indeed the case, these two phenomena are readily explainable from a psychosociological standpoint. In societies characterized by employment insecurity, in which power mechanisms are embodied in individuals, (1) information is a greater source of power than elsewhere. To hold information exclusively is a guarantee of security; to transmit it ostentatiously enhaces the social prestige of the one possessing the information. These inconsistencies do not further the flow of information and ideas, and the obstruction of communications observed sometimes has deep roots that are not at the level of individual psychology but at that of overall social structures.

Pursuing this example, if it is determined that recourse to a personal library is considered the principal means for obtaining information in view of the reasons analyzed above, it follows

(1) Luis Mercier Vega, Les mecanismes du pouvoir en Amérique Latine, Editions Pierre Belfond, 1967.

that the motivation for creating and developing informational institutions and mechanisms in the various communities will tend to be weak. All the foregoing considerations indicate that it is necessary to continue to correct the unilateral orientation of technical assistance based on organization of supply and to devote additional attention to the characteristics of demand and channels between the sources and users of information.

2. Alternatives Should be provided Regarding the Structures of the Scientific and Technological Information System

Seminars held by national "policy makers" of Argentina, Brazil and Mexico have provided a definition of a specific need: to establish a method which will facilitate adoption of the most important decisions for defining the structure of a national system of scientific and technological information.

OAS entrusted initial research in this matter to Battelle Memorial Institute. (1) On the basis of this study it has been possible to analyze the factors that govern monolithic structures--both co-ordinated and uncoordinated--and to compare them with national parameters.

(1) LISTON, Jr., David M., SCHOENE, Mary L., "Basic Elements of Planning and Design of National and Regional Information Systems", Battelle Memorial Institute, Columbus, Ohio/OAS, May 1971.

Discussion of this research with representatives of 17 Latin American countries established at least one firm conclusion: that the Latin American countries cannot afford the luxury of costly, chaotic and uncoordinated structures. Generally speaking, the alternatives favor coordinated structures in which the national research councils would play a central role. In some countries, where the existing structure is too weak--at least at the outset--a monolithic structure appears to offer the most practical approach.

In certain countries there has been some concern lest isolated measures adopted by a given institution, ministry, or university to establish its own information system may create a situation that will be difficult to correct. What is needed is overall programming which includes the recommendations of technical assistance experts and business contacts with enterprises that export technical information.

It is a well-known fact that scientific and technological information systems have been created without any planning whatsoever. (1)

(1) Office of Scientific Affairs of OECD: L'information dans une société en evolution: Quelques considérations de caractère politique, February 1971.

The case of the United States and the efforts of COSATI to coordinate subgroups show the difficulty of overcoming incompatibilities orginating in the coexistence of different systems, and that it is a costly process. It is advisable to avoid such expensive evolutionary errors in establishing information systems in developing countries.

In Latin America, the problem is complicated by the fact that, as in other underdeveloped areas, inter-industrial relations are generally limited and of poor quality. The general finding of H. Brooks (1), to the effect that one of the obstacles to communications is the purely vertical bureaucratic structures that characterize most governmental organizations, is patent in Latin America. In turn, this obstacle is reflected negatively at the decision-making and policy-formulating level. However, major decisions and, particularly, those pertaining to technological transfer and development, require interdependent policies. That is why the development of information systems can be a decisive instrument for breaking this vicious circle. But it is still necessary to establish rational systems in relation to national objectives, with consistent structures geared to subgroups

(1) H. Brooks, Science et Société, OECD, 1971.

that are gradually implemented on the basis of priorities and not on that of a jumble of well-intentioned but disparate measures. Consequently, promotion of scientific and technological information systems in Latin America will require a policy-making function at a high level of governmental responsibility. That is the current trend. Therefore, the first task of technical assistance should consist of helping policy-makers become aware of alternatives regarding the structure of the scientific and technological information system. Implementation of sub-groups of objectives should follow.

3. The Scientific and Technological Information System Should Focus on Priority of Demands

The CACTAL conference considered 4 major categories of users of the scientific and technological information system: scientists and other professional research personnel, enterprises, leaders of scientific and technological development policy, and the public. Overall needs for information are enormous. For example, it is necessary to establish a real science public relations policy, with the object of contributing to creation of scientific public opinion, publicizing achievements of Latin American science and technology, evaluating local innovations, enhancing the social

standing of scientists and technologists, etc. Much remains to be done to improve the quality of information provided by scientific research personnel to facilitate contacts with their colleagues in industrialized countries, etc.

Such activities are important and should be carried out, but they are not as urgently needed as the organization of technological information by enterprises. Although Latin American scientific information may contain gaps, in view of its quality and the relatively better inter-relationships that characterize it, it is appreciably better than that available in national Latin American enterprises regarding technological alternatives. As only foreign affiliates benefit from improved information facilities, the core of the scientific and technological information system should be related to the technological development requirements of the national productive sectors. Therefore, the main function of a Latin American scientific and technological information system should be to help to correct the serious deficiencies that have appeared in present international technology transfer mechanisms. That is why the CACTAL conference felt that the scientific and technological information system should establish liaison with organized mechanisms for technology transfer, and made

establishment of such liaison the object of one of the principal recommendations of the intergovernmental conference.

Only organized mechanisms can ensure achievement of the established objectives, namely: regulation of the technology market; importation of technologies that will be more appropriate in view of local production factors; reduction of transfer costs; elimination of restrictive trade practices; adaptation of technology; and the creation of new technology. It appears that information systems regarding technological alternatives, their costs, and their economic and social impact lie at the very heart of technology transfer mechanisms. They should make it possible to indicate the entire range of alternative solutions, and to seek useful factors for evaluating and selecting appropriate technology. They should facilitate the adoption of clear-cut decisions at the entrepreneurial and governmental levels, as well as coordination and greater consistency in policies pursued by the various institutions concerned. Above all, they should help to relate the scientific and technological infrastructure with the national entrepreneurial sector through two-way information mechanism That is why in the Organization of American States the promotion of scientific and technological systems has been included in the technology transfer program.

III. The OAS Technology Transfer Program and the Pilot Project

a) The Technology Transfer Program

This integrated program consists of studies, technical assistance, training, pilot experiments, and negotiations. The field covered includes both technology marketing mechanisms and information systems.

The program is implemented in conformity with an action program comprising the following phases: diagnosis of the situation; establishment of objectives of the strategic study; determination of the objective of the system (that is, the system over the long run); orientation of the system (guidance, phase by phase, toward the objective); a pilot experiment in technology transfer; and an action project at the national and regional levels. The attached flow chart summarizes the managerial concept of the program. (1) (Annex I).

On the basis of the strategic study, which comprises 44 studies, it has been possible to determine the broad long-term outlines of the system. This model of the proposed system has provided

(1) See GONOD, P.: Une nouvelle approche d'intervention-système sur le plan international: le programme de transfert de technologie de l'Organisation des Etats Américains. August, 1972.

a basic hypothesis for implementing the pilot experiment in technology transfer.

b) The Pilot Experiment

The object of this activity is to test national and regional mechanisms in order to improve conditions of technological transfer in Latin America. The object of the mechanisms will be to execute the following functions effectively and permanently:

1. Acquisition of information on technological alternatives;
2. Evaluation and selection of existing technologies;
3. Identification of needs for adaptation of foreign technology; and
4. Acquisition of foreign technology.

The experiment has been organized in the following 10 countries of the region: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay, and Venezuela. The Central American republics will constitute a single focal point, while the position of Mexico will be determined on a continuing basis.

The following industrial activities will be covered throughout the experiment:

Food Industries: Transformation and preservation of fruits and vegetables (item 3113 of the United Nations international classification of activities). Processing and preservation of fish and shellfish (including fisheries activities 3114 and 1301).

Chemical Industry: Production of raw materials for the plastics industry (3513). Transformation of plastic materials (3560).

Basic Industries: Iron and steel industries (3710). Non-ferrous metals industries (3720).

The experiment in technology transfer will not cover all the activities within each of the sectors mentioned above but only part of them, in the light of stated and identified needs at the entrepreneurial or governmental levels. To some degree, the outlines and limitations of the experiment will be determined by identified demand for technological change; only a limited number of enterprises will be covered in each country.

A description of the operational mechanism will facilitate understanding of how the project will be organized. The experiment will be organized on the basis of national focal points and a regional focus located in Washington. The program for national focal points is conceived as a provisional grouping of national institutions that deal with technology transfer, such as: national scientific research councils, economic and social planning agencies, Ministries of Industry and Foreign Trade, national patent offices, national productivity centers, agencies for technical assistance for enterprises, documentation centers or appropriate

libraries, and lending or investment-financing agencies.

The above list is not exhaustive and may vary from country to country. Thus, the pilot project will be an effort to put organizations of the vertical type in communication with decision-making entities of the horizontal type.

In the initial phase, the national focal points will select a group of enterprises which have specific projects for technological change. Later, other enterprises will be selected to assist in identifying implicit demand for technological change, development and transfer. Therefore, criteria for the selection of projects have been adopted with the object of ensuring that the experiment will have maximum impact on decision-making procedures of enterprises, within limitations of time and financing.

The regional focal point will consist of a team comprising the coordinator of the project and specialists in various functions: information, evaluation of technology, and negotiations for acquisition of technology. The team will be supported by specialists of the technology transfer program and the administrative infrastructure of the Department of Scientific Affairs of the OAS.

The regional focal point will compile information on technological alternatives and will determine the state of the art in selected sectors. This compilation of information will be effected at the

world level with the collaboration of UNIDO, specialized agencies of the United States government, and the information analysis services and technological centers of other countries. In addition to general information on the evolution of technologies and their obsolescence, the regional focal point will prepare detailed responses to technology requests formulated by enterprises. Information will be analyzed with the assistance of Latin American specialists. Their participation should facilitate preparation of "messages" adapted to the needs of end-users.

With the contributions of the regional focal point in hand, the national focal points will analyse the state of the art and evaluate technological alternatives from the national and local point of view. This evaluation will specifically include national parameters pertaining to available production facilities, materials, manpower, and their costs. National evaluations of technological alternatives will be disseminated among the enterprises, and a dialogue will be established with the latter with the object of selecting the technology most appropriate to their specific needs.

The information functions implicit in the above activities are of decisive importance for the Pilot Project. They are summarized in the attached flow chart (Annex II) of the technology transfer experiment. It is hoped that the experiment will be an original

one which will facilitate determination of the most appropriate mechanisms for technology transfer at both the national and regional levels, and will at the same time demonstrate an effective information system for the enterprises and the leaders of technological development policy.

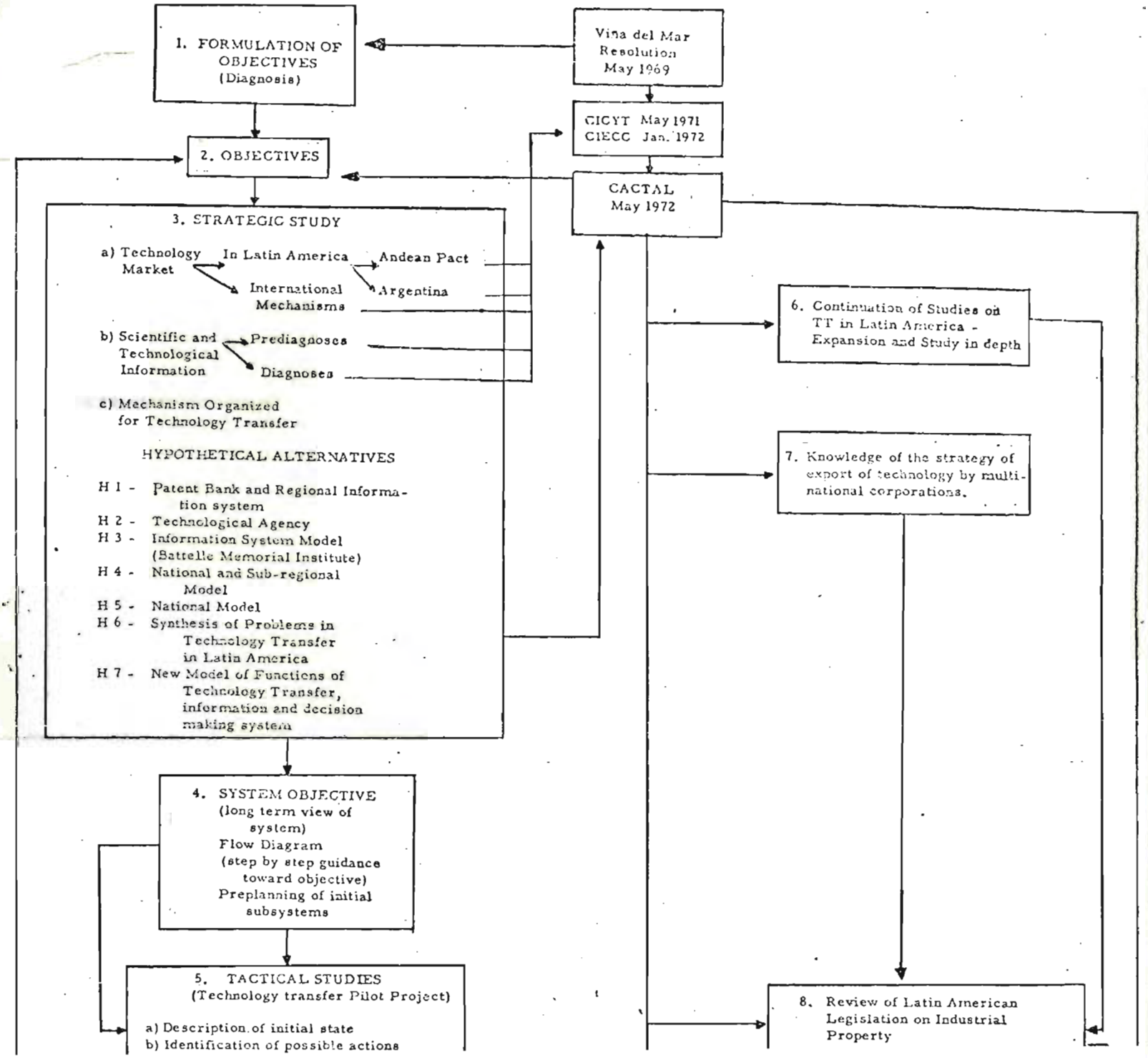
IV. Conclusion

Latin America, which is characterized by marked inequalities between the various countries and their potentials, is ready for the establishment of scientific and technological information systems. This is a new and significant development.

However, in the light of experience in industrialized countries, it is important to ensure that such systems will not evolve without planning. This will require sound analysis of both expressed and potential demand and of the organization of the supply of information. The principal problem pertains to entrepreneurial information about technology transfer. It must be resolved despite the inconveniences of existing mechanisms. This will require experimental implementation of programs, transition to a pilot project to test development of information on technological alternatives, its evaluation and, finally, selection of those technologies that are appropriate to national development objectives and available production facilities.

EXAMPLE OF OPERATIONS SYSTEM
TECHNOLOGY TRANSFER PROGRAM OF THE ORGANIZATION
OF AMERICAN STATES

ANNEX I



FLOW CHART OF OAS TECHNOLOGY TRANSFER EXPERIMENT

The System Flow Chart is a simplified schematic outlining the relationships of, and the information flows between, the five major elements of the Pilot Project on Technology Transfer. The five organizational elements in the technology transfer process are: 1) Users of technology at the national level (private enterprises or government agencies); 2) The National Focal Point; 3) National Sources of Technology and Information; 4) The Regional Focal Point at the Organization of American States Secretariat; and 5) World Sources of Technology and Information.

The significant information content of the technology transfer process is contained in three documents, which in themselves form a closed loop. The documents are the "Technology Requirement", the "Technology Profile" and the "Technology Prospectus". A "Technology Requirement" is a short, concise statement which describes a need for the solution to a specific technical problem. The solution desired may be a system or process; a sub-system, device, component, or material; or a method, technique or conceptual approach to satisfying the technology requirement. Technology Requirements are prepared by "Users" with the assistance of the National Focal Point.

The Technology Requirement is disseminated to potential sources of solutions - R and D organizations, universities, corporations, government research agencies, etc., throughout the world. A "Technology Profile" form accompanies the Technology Requirement. The

Technology Profile form has spaces for the potential supplier of technology to describe his solution and to indicate its original source, availability (terms and conditions of licensing, sale, joint venture, etc.), stage of development (prototype, production model, etc.), patents, etc.

The Technology Profile form is returned to the Regional Focal Point for determination of its applicability to a specific Technology Requirement. If the technology thus submitted is considered relevant to a Technology Requirement, the Regional Focal Point will investigate the technology indepth and prepare a report - the "Technology Prospectus" - for the National Focal Point and the User who originated the requirement.

The Technology Prospectus is an elaboration of the Technology Profile. It includes a discussion of how the technology can be adapted to the user's specific requirement, economic projections of potential cost/benefits, and a suggested program of action for the User, as appropriate. The Technology Prospectus is sent to the National Focal Point for review and modification, for better "fit" with the User's situation. The National Focal Point will have access to local information and data which were not available at the Regional level. It will also have first hand knowledge of the User's operations and can thus suggest a specific program to acquire and adapt the subject technology.

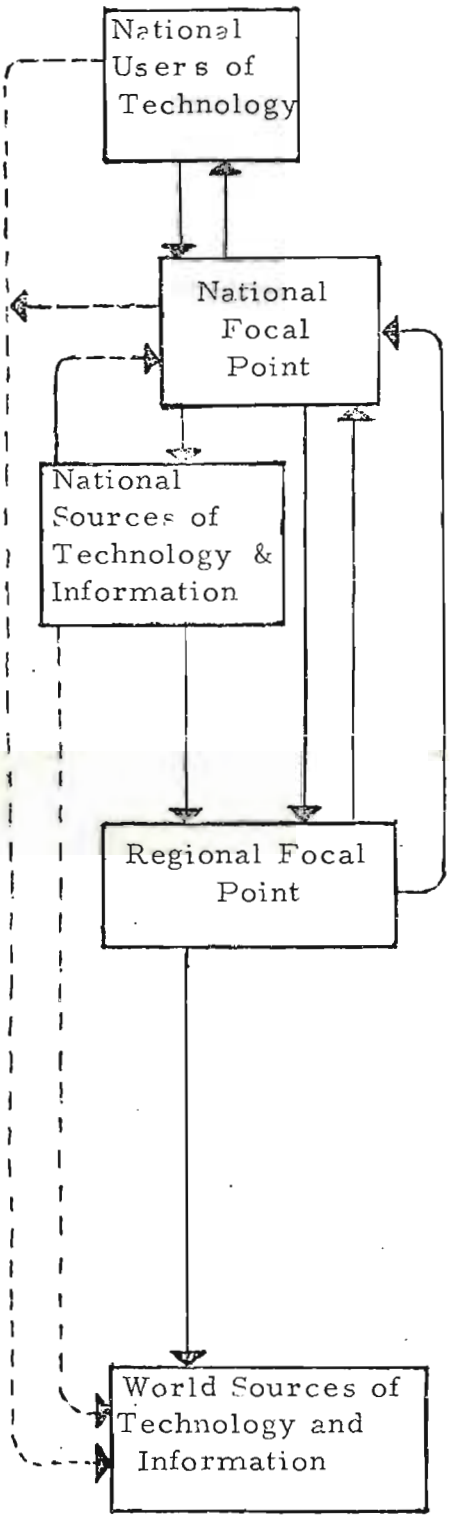
The National Focal Point will call on national sources of technology, the Regional Focal Point, and the source of the technology, if needed, to assist the implementation effort.

If the User rejects the technology, he will state his reasons to the National Focal Point. The reasons will be sent to the Regional Focal Point which will communicate them back to the source of the technology. A review of the reasons for rejection will assist in finding technology more appropriate to the requirement or will result in modification of the Technology Requirement itself to assure better answers in the future.

The channels of communication with technology generating sources throughout the world that are developed in this system will also be used to acquire a variety of technical information to satisfy other stated needs of Users and the National Focal Points. Selected sources will also be used to compile "State of the Art" surveys in areas of specific interest.

FLOW CHART OF OAS TECHNOLOGY TRANSFER EXPERIMENT

I. PROBLEM IDENTIFICATION AND SEARCH PHASE



1. Review operations to identify technical problems.
2. Develop technology requirements (TRs) (Including later modification).

3. Contact Potential Users.
4. Develop technology requirements (& records).
5. Send clarified TRs to:
   - 5.1 National sources
   - 5.2 Regional Focal Point

6. Receive and log TRs.
7. Review TRs for clarity (obtain clarification from NFP).
8. Prepare plan for technology search and TR dissemination.
9. Print TRs.
10. Disseminate TRs and Technology Profile Forms to:
    - 10.1 NFPs (For national sources)
    - 10.2 World sources
11. Contact directly selected sources of technology and information.

12. Receive and circulate TRs, within organization.

Key:

—— "Formal" Information Flow in PPTT.

--- Available channels for direct communication

xxxxx Support available to implement TT (From NFP, NS, RFP, WS)