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SCIENCE AND TECHNOLOGY IN LATIN AMERICA: TRENDS AND ASPIRATIONS

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SCIENCE AND TECHNOLOGY IN LATIN AMERICA: TRENDS AND ASPIRATIONS

(Commented summary of the problems and aspirations shared by the countries of Latin America, in connection with the application of science and technology for development, as revealed in the national monographs prepared for the United Nations Conference on Science and Technology for Development (UNCSTD), and which have been received on 23 October 1978).

INTRODUCTION

This document is based on an analysis of the national monographs for UNCSTD, which have been received to date by the CEPAL Science and Technology Unit. Insofar as possible, the order of the topics included in the programme of the United Nations Conference on Science and Technology for Development was followed.

The document is not as complete as we would have wished for three reasons: 1) until now we have not received the monographs from several countries and others have not even sent in a summary of the monograph; 2) the coverage and exactness of the Conference topics vary greatly in the documents that have been analyzed, and 3) the need for finding common denominators and broadly coinciding points has forced us to omit from analysis several singular aspects included in some monographs.

I. GENERAL CHARACTERISTICS OF SCIENCE AND TECHNOLOGY IN LATIN AMERICA

The principal characteristic that emerges from an analysis of the national monographs and from our knowledge of the countries that have not yet sent them in, is the great similarity that exists among the countries of the region concerning the problems they face regarding the use of science and technology for development, the difficulties found in effective management of technology based on national needs and interests, and the policies and institutional arrangements that are adopted in an effort to eliminate these problems and difficulties. Differences may be pointed out among groups of countries regarding their industrial progress in some fields (many of which are dominated by a technology alien to the country), there may be specific cases of the utilization of technologies that are complex or that possess a high level of "modernization", some countries may be endowed with a national capacity for handling certain technologies or advanced engineering services, differences in the quantity and quality of research laboratories may be found, etc., but neither the regional distribution of these characteristics nor the light that the analysis of national documents throws on global technological advance - bearing in mind endogenous and exogenous factors - make it possible to establish qualitative differences among the countries of the region in terms of the situation of science and technology in the Latin American and Caribbean countries. It is a question of broader markets, in many instances absorbed by transnational corporations, and of differences in scope in terms of resources applicable to scientific and technological activities, which do not affect the structural deficiencies caused by a lack of autonomy in decisions regarding the application of science and technology for development and which do not touch upon the problems of integral development and fair social distribution of the benefits that might be derived from technological innovations in the country.

Within this field of vision, which emphasizes the similarity of structural problems above and beyond differences of levels or subtle nuances, we may state - after having read the major part of the national documents - that the most characteristic aspects of the situation of science and technology in Latin America and the Caribbean are:

a) Excessive dependence on imported know-how, especially through transnational corporations;

b) Scarce social and cultural "internalization" of science and technology;

c) Inadequate levels of private and public spending in scientific and technological activities;

d) Lack of integration of the technological variable in development policies and national plans and programmes;

e) Insufficient training and scarcity of human resources dedicated to scientific and technological development;

f) Little operative interaction between productive units and the bodies in charge of scientific and technological activities;

g) Lack of coherence in the management of the different instruments and activities that should shape a national technology policy, and

h) Production and consumption patterns that do not bear any relation to the needs of the majority of the population.

II. NATIONAL SCIENCE AND TECHNOLOGY POLICIES

Insofar as national science and technology policies are concerned, the Latin American and Caribbean countries explicitly outline in their national documents a series of aspects which, given the logical differences in detail, intensity and other subtle shadings, offer great similarities. Some of the most prominent of these aspects are:

a) The expressed need to foster autonomous scientific and technological development, which will enable the country to achieve greater independence in its productive system, more rational use of natural resources, and increase in exports and their value, and greater satisfaction of the needs of the people, with greater emphasis on the least favoured sectors of the population;

b) Closely related to the preceding point, the need for effective control on imported technology, by considering this a complement and not a substitute for national efforts to generate technology;

c) The need to foster and reinforce basic and design consulting and engineering firms;

d) The need to more effectively link generation and adaptation of technologies with their utilization by productive units. This includes policies that affect the university system, national information centres and networks, research institutes, industrial extension services, state-owned companies, the state's purchasing power, the tax incentive system, etc.;

e) Priorities for areas of action. These include the agroindustry (especially in relatively less developed countries) and the capital goods industry (especially in the more developed ones);

f) The intention of linking national efforts in science and technology to the activities carried out at an international level which are aimed at achieving the establishment of a new international economic order;

g) The interest in giving greater relevance to the role that science and technology should play in national plans and programmes.

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This interest is expressed mainly through two major concerns: inserting the technological variable in national development plans and specifically indicating science and technology expenses in the national budget and accounts. Regarding the first concern, until now the countries that have shown the greatest progress in this field have limited themselves to establishing science and technology plans based on national plans, while they have not yet arrived at the methodology that would enable them to include the scientific and technological variable in the preparatory stages of the national plan. Concerning the second aspect, until now only some countries have attempted to reflect the expenses specifically assigned to science and technology in the national budget, and at the same time have been faced with serious methodological problems;

h) By and large, most of the countries have established differentiated plans and policies for science and for technology, as one of their central policy guidelines, based on the fact that the ownership, dissemination and handling of scientific know-how at an international and national level are different than they are for technological know-how. This does not signify neglect of scientific activities, whose value is recognized in culture, professional training and as a basis for applied research; it merely implies different treatment of the transfer and generation of both types of knowledge. In some cases differentiated policies are even proposed according to particular disciplines or sectors;

i) An element of policy which has been explicitly or implicitly stated in the national monographs, and which we consider to be of utmost importance, is that which refers to integral treatment of the different activities that conform the technological spectrum of a country, such as research and development, technical standardization, pre-investment studies, consulting and engineering firms, industrial extension, etc. It is only when all these elements have been taken into account that a real technological policy can be outlined which does not represent a palliative nor a simple list of actions, programmes and projects, but rather a coherent management of the generation, transfer, adaptation and utilization of technological know-how and the autonomous use of technology;

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j) Many of the national documents that were analyzed speak, with varying emphasis, of the support and development of "intermediate", "adequate" or "appropriate" technologies. Regarding these terms there is no unity of criterion (at least in the national monographs) in the Latin American and Caribbean region. Their interpretation and the policies, programmes and projects that arise from them show great variation both in concept and scope among the countries. Otherwise, and in spite of the importance of this topic, a confusion exists that repeats itself on a worldwide scale and is reflected in a lack of clarity with which it is handled at international levels. It is important, however, to point out that some countries do coincide in establishing within their express policy the conviction that highly labour-intensive and low productivity "intermediate" technologies should only be taken into account in the least strategic sectors of the economy, and that in the priority sectors there should be a concentration of efforts that will make it possible to utilize the most effective technology, disregarding its origin and degree of progress;

k) Since one of the most important factors that determine scientific and technological backwardness of the region is the scarcity of specialized human capital, it is not surprising that one of the most important aspects of scientific and technological policy of these countries is centered around the training, conservation and recuperation of specialized personnel. This has led to an interest in basic transformations of the educational system, its adaptation to the needs of the country, greater interaction between scientific-technical education and the productive sectors, greater opportunities and better working conditions for people engaged in research, repatriation for highly qualified personnel that has emigrated, better utilization of international technical and economic cooperation as sources of employment for national technicians, etc.

l) An area that is constantly mentioned as highly important in the national monographs, but about which there does not seem to be a clear concept of the policy that should be followed, is industrial property, which basically includes protection for trademarks and patents. Even

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though all the countries have some body in charge of granting this protection and many expressed their interest in the modification of the Paris Convention, very little - if anything at all - is contained in the national monographs on the actual role, past and present, of such an old institution regarding autonomous scientific and technological development, the obstacles or advantages it has contributed to national development, or the institutional policies or arrangements that should exist in order to place industrial property at the service of the country's interests;

m) We should also like to mention that several national documents place emphasis on the need for linking scientific and technological policy with indispensable changes in consumption and distribution patterns and the resulting changes in production, propaganda and marketing patterns.

III. INSTITUTIONAL ARRANGEMENTS FOR SCIENCE AND TECHNOLOGY[1/]

Perhaps the most prominent aspect of the similarities among Latin American and Caribbean countries is the history and present situation of institutional arrangements that have been established for the management of scientific and technological activities at the state level.

Insofar as history is concerned, it may be said that a general development pattern has been followed in the region, with slight variations in detail, style and period:

(a) During the colonial period, there were isolated cases of researchers engaged in scientific activities, who followed the models, patterns and interests in vogue in the major European cities. This research was usually financed by private individuals and in some cases, was carried out at the universities;

(b) Once independence had been obtained, this method was gradually modified as the university system became consolidated and the cost of scientific research increased. Recearch was then concentrated among university groups and soon general associations, such as national science academies, or specialized academies or societies dealing with medicine, astronomy, etc. appeared. Emphasis was still placed on some restricted fields of basic scientific research and there was still great dependence on European behavior patterns, based on the premise of "universal science";

(c) During the Second World War and in the years following in the industrialized countries and in particular the United States, gradually became aware of the importance that research and technological development represented for industrial development, and they realized that there was a need to organize these activities and to give them federal backing and financing. Many countries of the region, more from a sense of imitation than from political conviction, began to establish technological research programmes at their univirsities, to create scientific and technological research institutes, to establish so-called industrial laboratories and

1/ The aspects mentioned here were taken from: Isaías Flit, Apuntes para la historia de las instituciones científicas y tecnológicas en América Latina. This document has not yet been published.

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to institutionalize some technological activities, such as quality control and technical standardization. The initiatives that led to all of this were, in some cases, undertaken by the State, in others private, and still in others a combination of both;

(d) With the appearance of the OAS and the UN and their specialized bodies, a new phase was begun, which was characterized by discussions on the topic of science and technology at regional and international meetings, a proliferation of statements about the problem of science and technology in official documents and speeches, and the creation of sectoral research institutes largely financed by external contributions. The institutionalization and growth of bilateral technical and economic cooperation complemented the action of regional and international bodies during this stage. It should be noted, however, that the institutes and research centres that were established during this stage did not create the necessary liaisons with local production units and basically depended upon outside financial contributions;

(e) As a result of the national and international activity pointed out in the preceding paragraph, pressure groups (usually made up of scientists, technicians and state officials) emerged in these countries, with the financial and ideological support of the OAS, the United States National Academy of Sciences and the UNESCO, these groups precipitated the creation of state and state-affiliated bodies in charge of establishing national science and technology policies, generating scientific and technological development plans, advising Governments, coordinating the country's scientific and technological activities and promoting scientific and technological research. These bodies were usually formed in one of two ways: as national research councils or as science and technology units assigned to the respective Ministry or Secretariat of planning;

(f) Parallel to this, great unrest was created at both, national and international levels as to the conditions for undertaking the transfer of technology to the countries of the region. This led to a great many studies that revealed the abuses and negative characteristics of this transfer, and to the creation of legal and institutional systems aimed

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at obtaining better control in this area. The experience thus obtained has led to the need for setting up a bargaining forum within UNCTAD, for the establishment of an international code of conduct in the transfer of technology, which the majority of the countries in the region actively support.

As a result of this briefly outlined history, present institutional arrangements in Latin America and the Caribbean reveal a great basic similarity, with the exception perhaps of Cuba, owing to its particular social, economic and political structure and bearing in mind the new organization that the state apparatus of this country has recently undergone, which has produced a fundamental modification in the management of science and technology. With the exception of Cuba, then, in the rest of Latin America and the Caribbean, the different stages that shaped the development of institutional arrangements have formed at present a not very uniform mosaic in which private and public research bodies (general, sectoral, national, regional) coexist, usually without any coherence or concerted actions worthy of mention; information or extension centres and networks (general or sectoral); transfer of technology committees; industrial property offices; university research centres; industrial laboratories (private, state, sectoral, general, national, regional); standardization, quality control and metrology institutes (private or state); science and technology units which, in theory only, are in charge of coordinating the country's scientific and technological activities; associations for the advancement of science; national academies; professional schools, etc.

In spite of the inarticulate nature of this panorama, some countries of the region are trying to establish "national science and technology systems", which would function based on the concerted action of the different bodies mentioned previously.

IV. INTERNATIONAL COOPERATION FOR THE APPLICATION OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

The countries of the region are aware that the basic element for their scientific and technical development is their own capacity for handling know-how, and its proper inclusion in the productive system. Based on this premise, the fundamental objective of international cooperation is seen as the promotion of the endogenous scientific and technological development of each nation. In addition, the countries of Latin America and the Caribbean place special emphasis on activities of cooperation among developing countries within a scheme which begins at the subregional and regional level and then is extended to the rest of the developing world. As an example, several documents refer to the efforts made by the Latin American Economic System (SELA) for the constitution of the Latin American Technological Information Network (RITLA), which could later be integrated with other regional networks.

In general, in the national documents that were analyzed, a clear distinction was made between cooperation among developing countries and that which is carried out between these countries and developed nations; the trend is to subordinate the latter case to the needs set forth by the former and their national objectives.

Concerning cooperation among developing countries, joint action is sought above all else by countries that do not have, in certain cases, the resources necessary for solving common problems. This action is proposed in terms of exchange of information and experiences; assuming common positions; institutions dedicated to research and development maintained and utilized by several countries; priority utilization of engineering and consulting firms and institutions from developing countries; joint technological negotiations; establishmente of multinational engineering corporations and associations; and carrying out joint research projects in fields of common interest (research in non-conventional energy in general and solar energy in particular are frequently cited as examples).

The cooperation that is sought from developed countries also covers diverse aspects: eliminating restrictions in economic and technical

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cooperation programmes; providing better conditions in the transfer of technology; supporting developing countries at international meetings where they seek to outline their justly acquired aspirations regarding modifications of international conditions of technology flow and of the industrial property system; facilitating the flow of scientific and technical information from developed to developing countries; giving greater financial, administrative and institutional opportunities for the training and perfection of technicians from developing countries in the fields and areas of interest to these countries; earmarking a greater sum of money, without any conditions, for the development of the scientific and technological capacity of developing countries; supporting and participating in research and development programmes and projects in the fields and areas of interest to developing countries, and which would preferably be carried out in these countries; taking effective measures to diminish the migration of technicians from developing to developed countries, fostering their return and alleviating the negative effects of this migration on developing countries; and in general, adopting the necessary measures so that international cooperation becomes an effective instrument for the construction of a New International Economic Order.

V. UTILIZATION OF THE UNITED NATIONS SYSTEM

Regarding the United Nations system and its role in international cooperation the references made by the Latin American and Caribbean countries in their national documents were highly critical. The countries find that the proliferation of international bodies, their lack of coordination, duplication of functions, rigidity of their structures and administrative arrangements, and the conflicts that frequently arise among them, noticeably limit the possibilities of the United Nations system at present to make an effective contribution to the solution of the problems that the developing countries face in the field of science and technology.

As a result, the countries of the region suggest the need to restructure the United Nations system. Their proposal considers the following aspects: not to permit the establishment of new bodies; to enforce greater coordination among the elements of the system; to be more attuned to the needs and interests of developing countries; to have the flexibility necessary to make it more effective; and to make more rational use of the funds they are assigned.